CATALOGUE B.

Safford Radiators

1894

THE TORONTO RADIATOR MFG. CO., LTD.

TORONTO, ONT.

Eng.

PRINTERS
BROUGH & CASWELL
TORONTO

WORKS AND BRANCH WAREROOMS OF

The Toronto Radiator Manufacturing Company, Limited, Toronto.

Names and Addresses of Selling Agents and Representatives

Head Office and Works:

THE TORONTO RADIATOR MANFG. CO., Ltd. (The Largest Manufacturers in the Dominion)	366 to 376 Dufferin St.	TORONTO, Ont., Can.
HY. McLAREN & CO. Agents for Montreal and Province of Quebec	706 Craig Street	MONTREAL, Que.
MECHANICS' SUPPLY CO'Y Agents for Quebec City	96 St. Peter Street	QUEBEC, Que.
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ILLUSTRATED . . .
. . . CATALOGUE **B**

1893-4

OF

Safford HOT WATER AND STEAM Radiators

POWERS . . . .
TEMPERATURE
REGULATORS .

Kieley's Steam Traps and Specialties, used in connection with Heating Apparatus.
and Fittings

MANUFACTURED EXCLUSIVELY BY

The Toronto Radiator Manufacturing Co'y, Ltd.

TORONTO, ONT.

MONTREAL, QUE.
QUEBEC, QUE.
ST. JOHN, N.B.
HAMILTON, ONT.
WINNIPEG, MAN.
VICTORIA, B.C.

3-4

--Our Field is--

Around the World

1887... To Our Patrons ...1893

IN presenting our New Catalogue (Edition B) of Safford Radiators, we avail ourselves of the opportunity thus afforded to direct special attention to our extensive facilities for handling a very large trade, and to the character of our Works and Branch Warerooms.

We shall continue to manufacture the well-known Safford (patent) Hot Water and Steam Radiators, which have proven beyond peradventure superior in every particular to all other forms of Radiators now upon the market.

The Safford Radiator is constructed with screwed nipple connections, and is similar to the ordinary box coil (which has an iron to iron connection). No bolts, packing, or gaskets of any kind are used in our Radiators, consequently absolutely nothing to get out of repair. Both Water and Steam Radiators can be easily taken apart and repaired by any fitter without difficulty; we provide necessary tools for doing the work.

Safford Radiators are being specified for in all first-class buildings, and have been used in fully eighty per cent. of the new buildings erected during the past five years.

THE TORONTO RADIATOR MANFG. CO., LTD.

JOHN M. TAYLOR, Sec'y and Gen'l Manager.

Description of Hot Water Joints

WITH our patent right and left nipple system we are enabled to connect the loops of our Hot Water Radiator simultaneously at the top and bottom, without the use of bolts, packing, or lead, thereby producing connections that are (universally conceded to be equal to the old box coil) all iron, and, like our steam connections, are absolutely permanent.

Having the foregoing system of connection, we offer to the trade a Radiator far superior in construction to that of any other manufacturer on this continent. All other styles of Radiators depend largely on the bolts and packing, and which, by the constant expansion and contraction of a few short seasons' use, cracks the packing and stretches the bolts, resulting in disagreeable and expensive leaks.

The "Safford" system renders the making of additions and subtractions to the size of the Radiator very simple. On the inside of each nipple are heavy lugs, so that with a piece of wrought iron flattened out at one end, and inserted in the Radiator at the joint to be disconnected, one or more loops can be taken out independent of all the others. We are prepared to furnish wrenches to our customers to do this work.

Radiators Patented **Design Registered**

Description "Safford" Steam Joints

IT is universally conceded that the most important part of the construction of a Radiator is its joints, and, having sole control of the "Safford" patent right and left screwed nipple, it enables us to produce, not only an absolutely perfect joint, but with the patented machinery (which we also control) we obtain a faced joint by milling the surfaces perfectly true, thereby securing a double connection, and of the most practical known to mechanism.

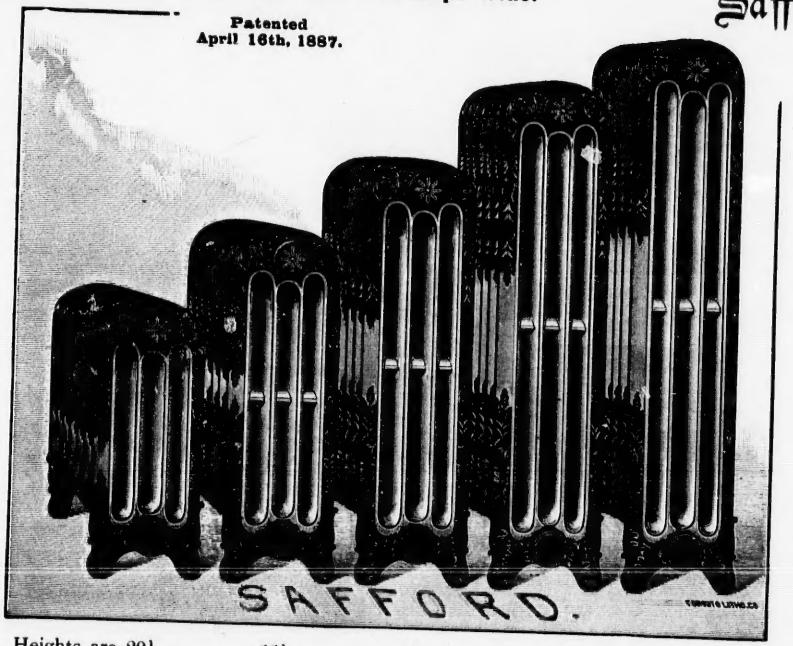
With our "Safford" right and left nipple system, each section is drawn face to face and held firmly without the use of red lead or any other substance, so commonly used by all other manufacturers. The screwed nipple makes an absolutely permanent joint; the longer it stands the tighter it becomes.

Every section of our Radiator is subjected to a pressure of 120 lbs. to the square inch, and after being assembled in stacks are again tested to the same pressure, thereby assuring steam fitters that there can be no possible liability of having leaky joints.

We use no bolts or packing of any description. The "Safford" system renders the making of additions and subtractions to the size of the Radiator very simple. On the inside of each nipple are heavy lugs, so that with a piece of wrought iron flattened out at one end, and inserted in the Radiator at the joint to be disconnected, one or more loops can be taken out independent of all the others. We are prepared to furnish wrenches to our customers to do this work.

"Favorite" Pattern, made four and two loops wide.

Patented
April 16th, 1887.



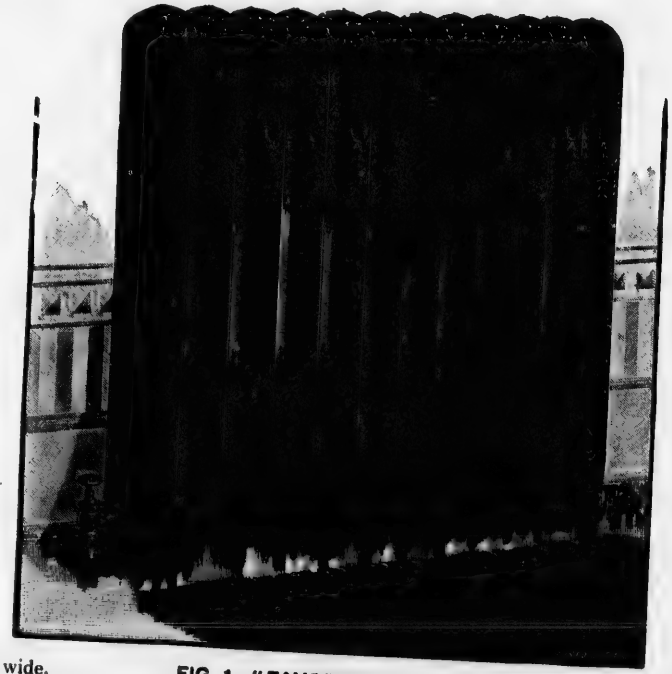
Heights are 20½, 26½, 32½, 38½, and 42½ inches.
Four loop, extreme width, 8½ inches. Two loop, extreme width, 6⅛ inches.

Safford Radiators

See tableted list of sizes.
Pages 10 to 26.

REGISTERED
Safford Radiators
TRADE MARK

fford Radiators



Four loops wide.

FIG. 1—"FAVORITE" PATTERN.

42⅛ inches high.

This Height

is specially adapted for rooms and halls where a very large amount of heating surface is required, and particularly where wall and floor spaces are limited.

eight

cially adapted for
and halls where
large amount of
g surface is re-
and particularly
wall and floor
are limited.

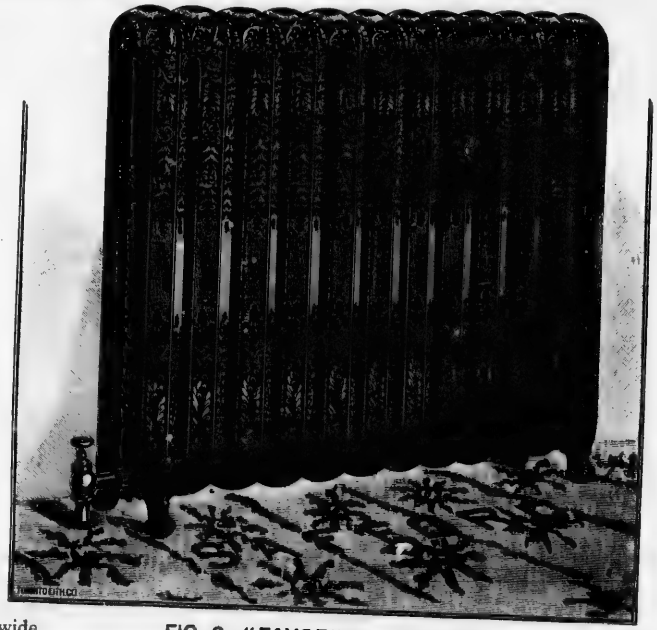
PRICE LIST—4 x 42½ INCHES HIGH

Four Loops Wide. Each Section contains 9⅔ Square Feet.

Nos.	Description of Radiator	Square feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
40	4 x 2	19.4	58	8½ inch	9 inch	$ 8.41	Aberdeen
41	4 x 3	29.	87	"	13 "	12.61	Acton
42	4 x 4	38.8	116	"	17 "	16.82	Addison
43	4 x 5	48.4	145	"	21 "	21.02	Adelaide
44	4 x 6	58.	174	"	25 "	25.23	Algoma
45	4 x 7	67.8	203	"	29 "	29.43	Almonte
46	4 x 8	77.4	232	"	33 "	33.64	Alton
47	4 x 9	87.	261	"	37 "	37.84	Ancaster
48	4 x 10	96.8	290	"	41 "	42.05	Arthur
49	4 x 11	106.4	319	"	45 "	46.25	Arnprior
50	4 x 12	116.	348	"	49 "	50.46	Athens
51	4 x 13	125.8	377	"	53 "	54.66	Aurora
52	4 x 14	135.4	406	"	57 "	58.87	Aylmer
53	4 x 15	145.	435	"	61 "	63.07	Ayr

4 x 42½
4 x 38½
4 x 32½
4 x 26½
4 x 20½
2 x 38½
2 x 32½
2 x 26½
2 x 20½

STANDARD HEIGHT



Four loops wide.

FIG. 2—"FAVORITE" PATTERN.

(Also two loops wide, page 19.)

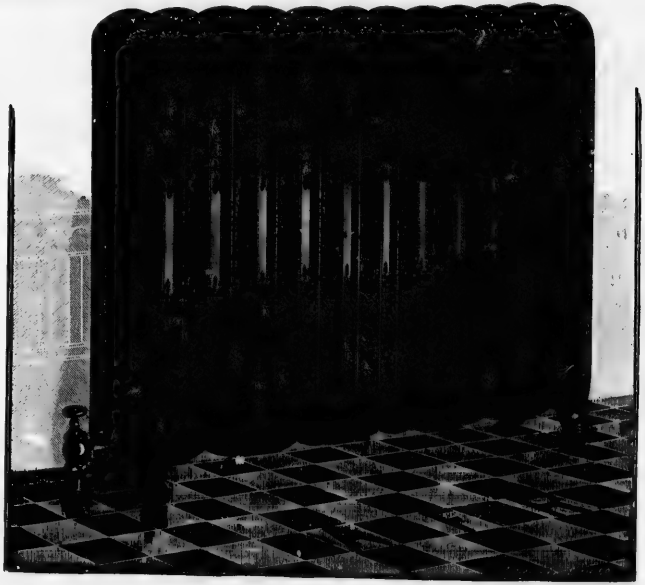
38½ inches high.

PRICE LIST—4 x 38½ INCHES HIGH

Four Loops wide. Each Section contains 8 Square Feet

Nos.	Description of Radiator	Square feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
54	4 x 2	16.	48	8½ inch	9 inch	$ 6.96	Barrie
55	4 x 3	24.	72	"	13 "	10 44	Bethany
56	4 x 4	32.	96	"	17 "	13.92	Binkham
57	4 x 5	40.	120	"	21 "	17.40	Bismarck
58	4 x 6	48.	144	"	25 "	20.88	Blackstock
59	4 x 7	56.	168	"	29 "	24.36	Blackburn
60	4 x 8	64.	192	"	33 "	27.84	Blenheim
61	4 x 9	72.	216	"	37 "	31.32	Blyth
62	4 x 10	80.	240	"	41 "	34.80	Bangor
63	4 x 11	88.	264	"	45 "	38.28	Bolton
64	4 x 12	96.	288	"	49 "	41.76	Bothwell
65	4 x 13	104.	312	"	53 "	45.24	Bowmanville
66	4 x 14	112.	336	"	57 "	48.72	Bradford
67	4 x 15	120.	360	"	61 "	52.20	Brantford

4 × 38½
4 × 32½
4 × 26½
4 × 20½
2 × 38½
2 × 32½
2 × 26½
2 × 20½



Four loops wide. **FIG. 3—"FAVORITE" PATTERN.** 32½ inches high.

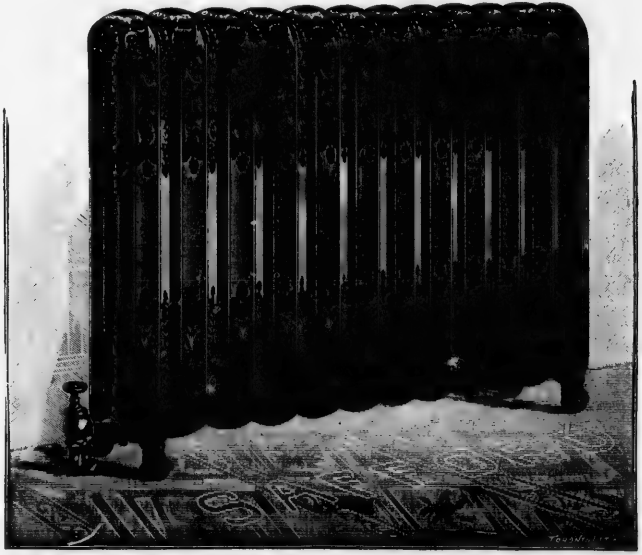
(Also two loops wide, page 21.)

PRICE LIST—4 x 32½ INCHES HIGH

Four Loops Wide. Each Section contains 6⅔ Square Feet.

Nos.	Description of Radiator	Square Feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
68	4 x 2	13.4	40	8½ inch	9 inch	$ 6.40	Cameron
69	4 x 3	20.	60	"	13 "	9.60	Camilla
70	4 x 4	26.8	80	"	17 "	12.80	Canaan
71	4 x 5	33.4	100	"	21 "	16.00	Canfield
72	4 x 6	40.	120	"	25 "	19.20	Cardinal
73	4 x 7	46.8	140	"	29 "	22.40	Carleton
74	4 x 8	53.4	160	"	33 "	25.60	Casselman
75	4 x 9	60.	180	"	37 "	28.80	Cataract
76	4 x 10	66.8	200	"	41 "	32.00	Cayuga
77	4 x 11	73.4	220	"	45 "	35.20	Chatham
78	4 x 12	80.	240	"	49 "	38.40	Claremont
79	4 x 13	86.8	260	"	53 "	41.60	Clayton
80	4 x 14	93.4	280	"	57 "	44.80	Clinton
81	4 x 15	100.	300	"	61 "	48.00	Colborne

4 x 32½
4 x 26½
4 x 20½
2 x 38½
2 x 32½
2 x 26½
2 x 20½



Four loops wide. **FIG. 4—"FAVORITE" PATTERN.** $26\frac{1}{2}$ inches high.

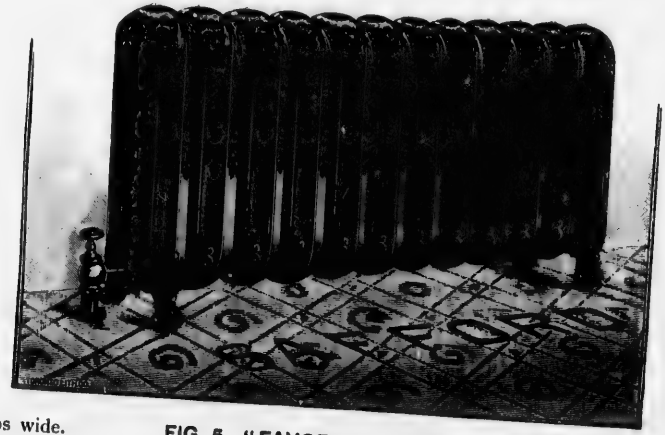
(Also two loops wide, page 23.)

PRICE LIST 4 x 26½ INCHES HIGH

Four Loops Wide. Each Section contains 5¼ Square Feet.

Nos.	Description of Radiator	Square Feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
82	4 x 2	10.8	32	8½ inch	9 inch	$ 5.60	Delhi
83	4 x 3	16.	48	"	13 "	8.40	Delta
84	4 x 4	21.4	64	"	17 "	11.20	Deseronto
85	4 x 5	26.8	80	"	21 "	14.00	Dixie
86	4 x 6	32.	96	"	25 "	16.80	Doon
87	4 x 7	37.4	112	"	29 "	19.60	Drayton
88	4 x 8	42.8	128	"	33 "	22.40	Drumbo
89	4 x 9	48.	144	"	37 "	25.20	Dundas
90	4 x 10	53.4	160	"	41 "	28.00	Durham
91	4 x 11	58.8	176	"	45 "	30.80	Dutton
92	4 x 12	64.	192	"	49 "	33.60	Dwight
93	4 x 13	69.4	208	"	53 "	36.40	Dunsford
94	4 x 14	74.8	224	"	57 "	39.20	Dunnville
95	4 x 15	80.	240	"	61 "	42.00	Dunlop

4 x 26½
4 x 20½
2 x 38½
2 x 32½
2 x 26½
2 x 20½



Four loops wide.

FIG. 5—"FAVORITE" PATTERN.

(Also two loops wide, page 25.)

Height, 20½ inches.

Made to suit any angle for low windows.

Can be furnished 18½ inches high to order . . . . .

PRICE LIST—4 x 20½ INCHES HIGH

Four Loops Wide. Each Section contains 4 Square Feet.

Nos.	Description of Radiator	Square Feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
96	4 x 2	8	24	8½ inch	9 inch	$ 4.56	Eagle
97	4 x 3	12	36	"	13 "	6 84	Eastville
98	4 x 4	16	48	"	17 "	9.12	Eden
99	4 x 5	20	60	"	21 "	11.40	Edgar
100	4 x 6	24	72	"	25 "	13.68	Elgin
101	4 x 7	28	84	"	29 "	15.96	Elliott
102	4 x 8	32	96	"	33 "	18.24	Elma
103	4 x 9	36	108	"	37 "	20.54	Elmira
104	4 x 10	40	120	"	41 "	22.82	Elora
105	4 x 11	44	132	"	45 "	25.10	Embro
106	4 x 12	48	144	"	49 "	27.38	Emerald
107	4 x 13	52	156	"	53 "	29.66	Enterprise
108	4 x 14	56	168	"	57 "	31.94	Erie
109	4 x 15	60	180	"	61 "	34.24	Esther

4 x 20½

2 x 38½

2 x 32½

2 x 26½

2 x 20½

STANDARD HEIGHT

Two loops wide. FIG. 6—"FAVORITE" PATTERN, Height, 38½ inches.

PRICE LIST—2 x 38½ INCHES HIGH

Two Loops Wide. Each Section contains 4 Square Feet

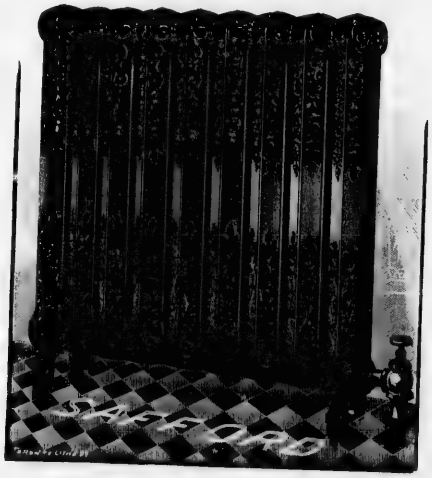
Nos.	Description of Radiator	Square Feet of Heating Surface	Equiv. For One-inch	Extreme Width	Extreme Length	Price Complete	Telegraph Code
110	2 x 2	8	24	6½ inch	8 inch	$ 3.48	Fairbank
111	2 x 3	12	36	"	11½ "	5.22	Fairmount
112	2 x 4	16	48	"	15 "	6.96	Fairview
113	2 x 5	20	60	"	18½ "	8.70	Fargo
114	2 x 6	24	72	"	22 "	10.44	Fenwick
115	2 x 7	28	84	"	25½ "	12.18	Fergus
116	2 x 8	32	96	"	29 "	13.92	Fermoy
117	2 x 9	36	108		32½ "	15.66	Fingal
118	2 x 10	40	120	"	36 "	17.40	Flamboro
119	2 x 11	44	132	"	39½ "	19.14	Florence
120	2 x 12	48	144	"	43 "	20.88	Fonthill
121	2 x 13	52	156	"	46½ "	22.62	Forest
122	2 x 14	56	168	"	50	24.36	Formosa
123	2 x 15	60	180	"	53½	26.10	Frankford

2 x 38½

2 x 32½

2 x 26½

2 x 20½



Two loops wide.

FIG. 7—"FAVORITE" PATTERN.

This Pattern

is well adapted for Bath Rooms and Lavatories, or where small amount of surface is required.

Height, 32½ inches.

PRICE LIST—2 x 32½ INCHES HIGH

Two Loops Wide. Each Section contains 3⅕ Square Feet.

Nos.	Description of Radiator	Square feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
124	2 x 2	6.8	20	6½ inch	8 inch	$ 3.20	Galetta
125	2 x 3	10.	30	"	11½ "	4.80	Galt
126	2 x 4	13.4	40	"	15 "	6.40	Gananoque
127	2 x 5	16.8	50	"	18½ "	8.00	Garnet
128	2 x 6	20.	60	"	22 "	9.60	Georgetown
129	2 x 7	23.4	70	"	25½ "	11.20	Gibson
130	2 x 8	26.8	80	"	29 "	12.80	Gilford
131	2 x 9	30.	90	"	32½ "	14.40	Glanford
132	2 x 10	33.4	100	"	36 "	16.00	Gladstone
133	2 x 11	36.8	110	"	39½ "	17.60	Glencoe
134	2 x 12	40.	120	"	43 "	19.20	Glendale
135	2 x 13	43.4	130	"	46½ "	20.80	Glenroy
136	2 x 14	46.8	140	"	50 "	22.40	Goderich
137	2 x 15	50.	150	"	53½ "	24.00	Goodwood

2 X 32½

2 X 26½

2 X 20½

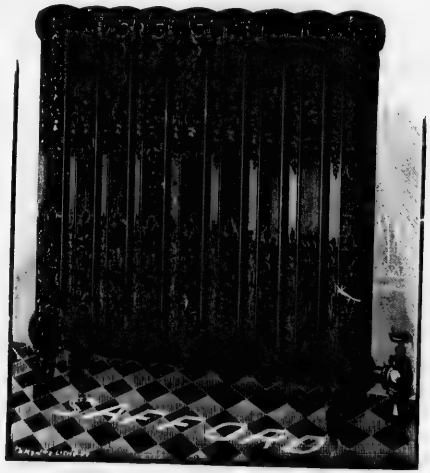


FIG. 8—"FAVORITE" PATTERN.

Two loops wide.

Height, 26½ inches.

Suitable for
Windows
Base Boards
Curved Walls
Etc. . . .

PRICE LIST—2 x 26½ INCHES HIGH

Two Loops wide. Each Section contains 2⅔ Square Feet

Nos.	Description of Radiator	Square feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
138	2 x 2	5.4	16	6½ inch	8 inch	$ 2.80	Hamilton
139	2 x 3	8.	24	"	11½ "	4 20	Havelock
140	2 x 4	10.8	32	"	15 "	5.60	Huntsville
141	2 x 5	13.4	40	"	18½ "	7 00	Halton
142	2 x 6	16.	48	"	22 "	8.40	Hamburg
143	2 x 7	18.8	56	"	25½ "	9.80	Hammond
144	2 x 8	21.4	64	"	29 "	11.20	Hanover
145	2 x 9	24.	72	"	32½ "	12.60	Harold
146	2 x 10	26 8	80	"	36 "	14.00	Harriston
147	2 x 11	29.4	88	"	39½ "	15.40	Hartford
148	2 x 12	32.	96	"	43 "	16.80	Hastings
149	2 x 13	34.8	104	"	46½ "	18.20	Haydon
150	2 x 14	37.4	112	"	50 "	19.60	Hensall
151	2 x 15	40.	120	"	53½ "	21.00	Holly

2 X 26½

2 X 20½

Safford Radiators

A Radiator designed for Low Windows, or where base board heaters are required this size can be more easily fitted than any other style in the market.

Made to suit any templet or sketch on shortest notice.

For specially low windows this pattern can be furnished 18½ inches high.

Two loops wide.

FIG. 9—"FAVORITE" PATTERN.

Height, 20½ inches.

PRICE LIST—2 x 20½ INCHES HIGH

Two Loops Wide. Each Section contains 2 Square Feet.

Nos.	Description of Radiator	Square Feet of Heating Surface	Equivalent Feet of One-inch Pipe	Extreme Width	Extreme Length	Price Complete	Telegraph Code
152	2 x 2	4	12	6½ inch	8 inch	$ 2.28	Kenne
153	2 x 3	6	18	"	11½ "	3.42	Kemble
154	2 x 4	8	24	"	15 "	4.56	Kingston
155	2 x 5	10	30	"	18½ "	5.70	Kent
156	2 x 6	12	36	"	22 "	6.84	Kilburn
157	3 x 7	14	42	"	25½ "	7.98	Kincardine
158	2 x 8	16	48	"	29 "	9.12	King
159	2 x 9	18	54	"	32½ "	10.26	Kinghorn
160	2 x 10	20	60	"	36 "	11.40	Kinmount
161	2 x 11	22	66	"	39½ "	12.54	Korah
162	2 x 12	24	72	"	43 "	13.68	Komoka
163	2 x 13	26	78	"	46½ "	14.82	Kirkton
164	2 x 14	28	84	"	50 "	15.96	Kirkwall
165	2 x 15	30	90	"	53½ "	17.10	Kinkora

2 X 20½

"DAISY" PATTERN, Flat Top

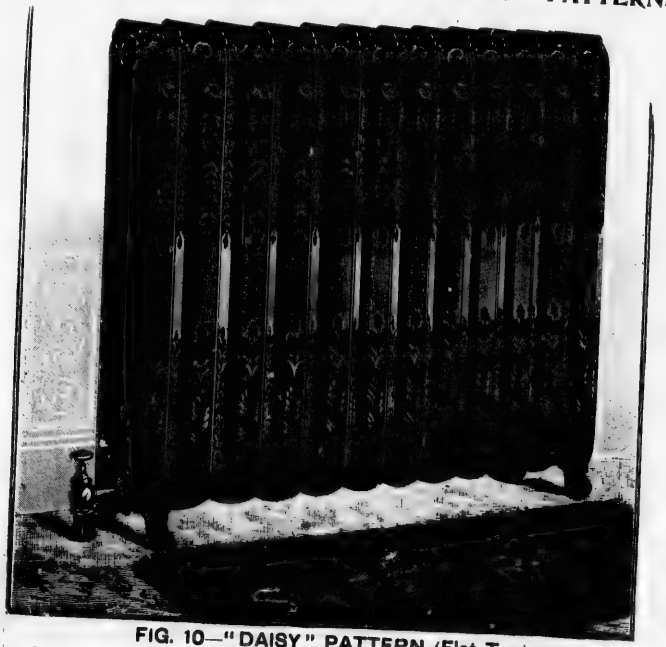


FIG. 10—"DAISY" PATTERN (Flat Top).

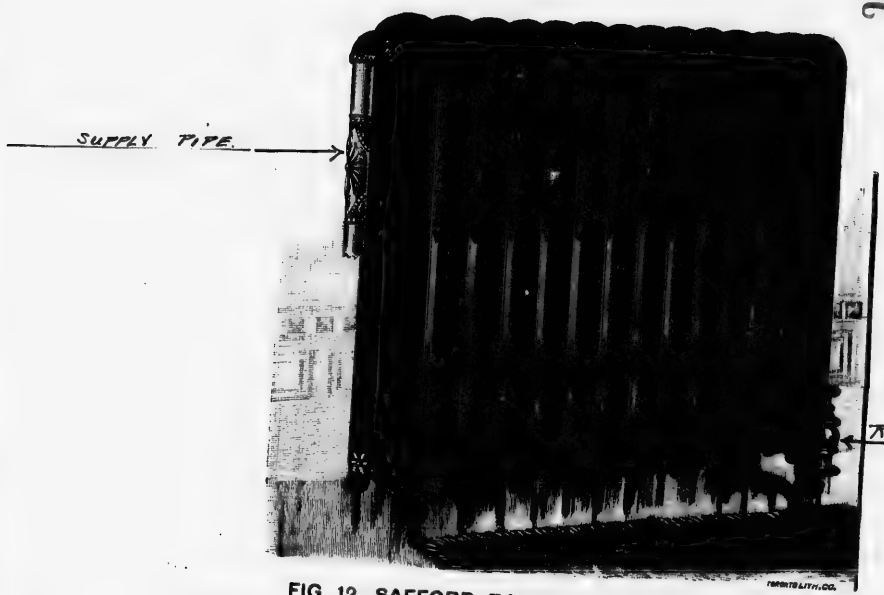
is style made Two or Four Loops wide; same heights and lists as on pages 10 to 26 apply to this Radiator.

RA CHARGE FOR THE ABOVE PATTERN.

Also made to suit
MARBLE
or
CAST-IRON TOPS
to order

FIG. 11—END VIEW OF (DOUBLE) OR TWIN CONNECTION RADIATOR

Any of the Radiators illustrated in this book will be furnished with Twin connections WITHOUT EXTRA CHARGE when ordered.



Made Top and Bottom Connection same end;

or . . .

Top Supply and Bottom return at opposite ends.

FIG. 12—SAFFORD RADIATOR (with Top Supply Pipe).

Made two and four loops wide. Heights, 20½, 26½, 32½, 38½, and 42½ inches.

Either "Favorite," "Daisy," or "Perfect" pattern.

List of Sizes and Prices same as on pages 10 to 26.

Dining-Room Radiator

WE are confident a consideration of our claims will convince all those in need of Steam or Hot Water Dining Room Radiators that the "**Safford**" is superior to all others on the market. The cuts show this Radiator to have three doors. The upper portion of the closet with double doors, when open, discloses two shelves twenty-one inches long, twelve inches wide, with nine inches space between each. The lower portion of the closet, with drop door, has one shelf the same length as those in the upper portion, and when the door is dropped forms a very convenient rest or shelf in addition to the shelf in the oven.

It is so constructed as to form a continuous steam or hot water space around the entire closet, making it air-tight, and overcoming completely the difficulty experienced by using Radiators where the hot closet sets upon short loops, which not only prevent the possibility of heating the oven to nearly so high a temperature as can be obtained in the "**Safford**," but also admits the dust and dirt to settle in the oven.

FIG. 13—DINING-ROOM RADIATOR (with Cast Iron Top).

Made for Hot Water or Steam. Four loops wide. Height, 38⅛ inches.

Sizes and Price List on page 30.

SIZES AND PRICE LIST.

Size	No. of loops in Radiator (exclusive of room)	Square feet of heating surface	Extreme length, inches	Price, without top	Price, with plain top	Price, with plated top
AA	2	21	28	$48.31	$50.25	$52.35
A	4	37	38	53.83	55.55	58.20
B	6	53	44	60.61	63.00	66.30
C	8	69	52	68.14	70.53	74.40
D	10	85	60	74.25	78.00	82.50
E	12	101	68	80.95	85.50	90.60
F	14	117	76	87.78	93.90	98.70

Made for Hot Water or Steam.

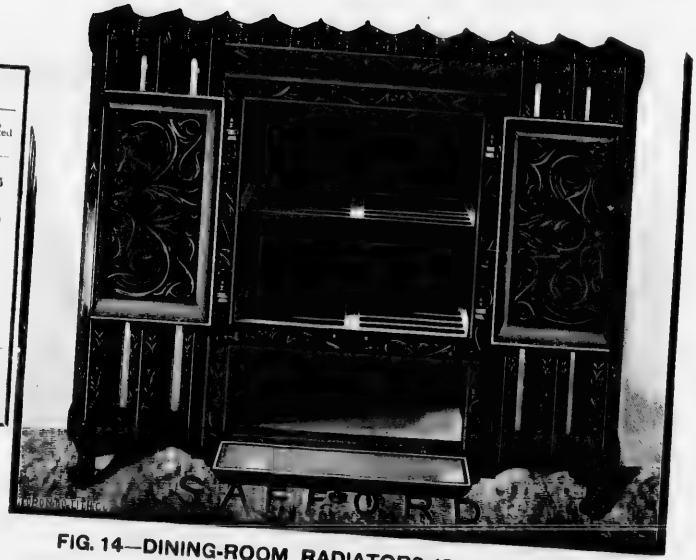


FIG. 14—DINING-ROOM RADIATORS (Open, without Top).

Four loops wide. Height, 38⅛ inches.

Safford Radiators

Made in
"FAVORITE,"
"DAISY," or
"PERFECT"
Pattern.

List of Sizes and Prices same as ordinary Radiators, with 38 cents per loop extra added to list prices.

Any Desired Style of Connection . . .

furnished without extra charge.

FIG. 15—CORNER RADIATOR, "FAVORITE" PATTERN.

For Steam or Hot Water. Two and four loops wide. Heights, 20½ to 42½ inches.

When ordering, send diagram; also state square feet of surface required.

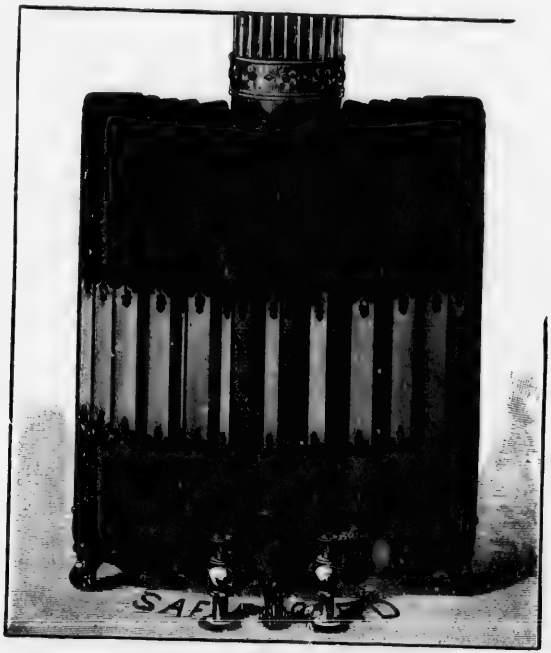


FIG. 16—CIRCULAR OR "COLUMN" RADIATOR.

Made for Steam or Hot Water. Two or Four loops wide.
"Favorite," "Daisy," "Perfect," or "Provincial" Pattern.

This style made to order. Smallest inside diameter, 16½ inches.

When ordering, state height and square feet of heating surface required.

*

Additional Cost . .

9 cents square foot to regular Price Lists.

Height, 20½ to 45 inches.

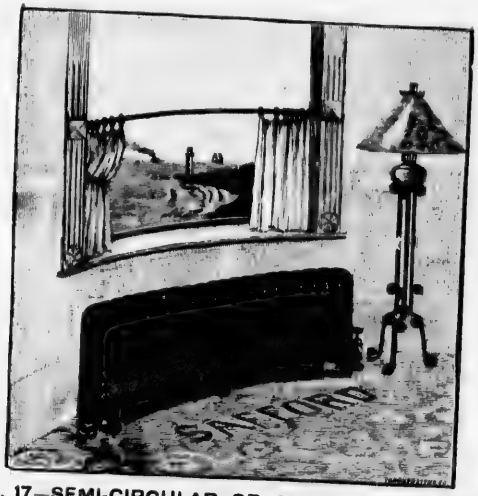


FIG. 17—SEMI-CIRCULAR OR CURVED RADIATOR.

Made in "Favorite," "Daisy," or "Perfect" Pattern.

Made for Hot Water or Steam. Two or four loops wide. Heights, 20½, 26½, 32½, 38½, and 42½ inches.

Radiators of this style made to suit any curve.

Add 37½ cents per loop to List Prices on pages 10 to 26.

When ordering, send diagram of curve desired.

A Special Radiator

designed for use in Schools, Hospitals, and Public Buildings. It combines in one a Heating and Ventilating Radiator.

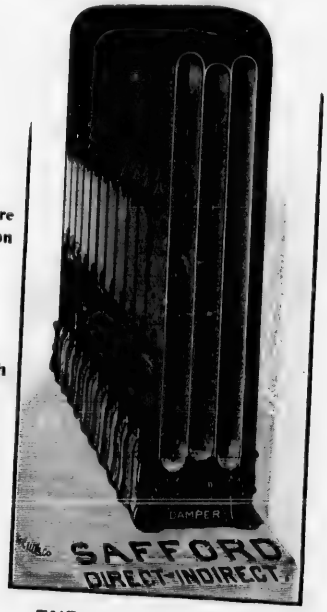
FIG. 18—DIRECT-INDIRECT RADIATOR.

Made for Hot Water or Steam. "Favorite" or "Perfect" Pattern.

Price List

Add 9 cents per square foot to List Prices on pages 10 to 26.

Made 20 to 45 inches high to order.



END VIEW OF FIG. 18.

Safford Radiators

Made in any of the different patterns shown in this Catalogue.

(To order only.)

Twin Connection, Top Supply, Single Connection, or One Pipe system.

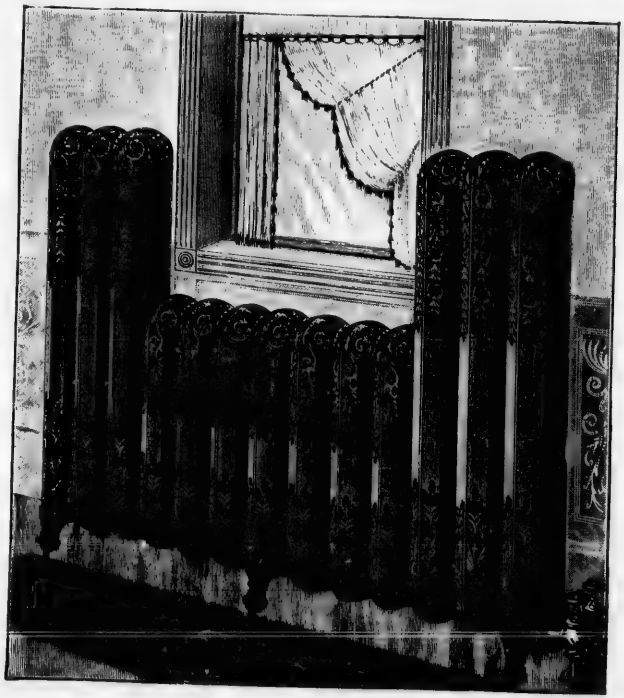


FIG. 19—WINDOW RADIATOR, "FAVORITE" PATTERN.

For Steam only; made to suit the requirements of any window. When ordering, send diagram of window. Prices quoted on application.

Safford Radiators

Loops are from 20½ to 45 inches high.

(To order only.)

Two or four loops wide.

✱

Made in . .

"FAVORITE,"
"DAISY,"
"PERFECT," or
"PROVINCIAL"

. . Patterns

FIG. 20—"FAVORITE" PATTERN.

Side or Stairway Radiator. For Steam only. Made to suit any desired pitch.

Prices quoted on application.

Safford Radiators

Full area of Heating Surfaces guaranteed

As shown on page 38.

*

Price List and Sizes on page 38.

Made into . .

Column, Semi-Circular, Corner, Window, or Stairway Radiators.

FIG. 21—SAFFORD "PERFECT" RADIATOR (with ornamental loops).

For Hot Water or Steam. Heights, 20, 26, 32, 38, and 45 inches.

Extreme width, 8½ inches.

Safford Radiators

"Perfect" and "Provincial" Patterns

DESCRIPTION

Steam Radiators

Width of Loop, 7½ inches. Width across feet, 8½ inches. Distance from floor to centre of inlet, 3⅜ inches.

Radiators containing 48 square feet and under, 1 x ¾ inch.

Radiators containing over 48 square feet, 1¼ x 1 inch.

When not ordered otherwise, Radiators will be tapped as above. If openings varying from the above are required, they will be provided without extra charge.

Hot Water Radiators

The heights and capacities of our Hot Water Radiators are the same as in the Steam Radiators. The flow and return openings are tapped as follows:

Radiators containing 48 square feet and under - 1 x 1 inch.
" " over 48 square feet - - 1¼ x 1¼ "

PRICE LIST

Height	20 in.	26 in.	32 in.	38 in	45 in.
Hot Water, per sq. foot	$0 57	$0 52½	$0 48	$0 43½	$0 43½
Steam, per sq. foot	52½	46½	42	37½	37½

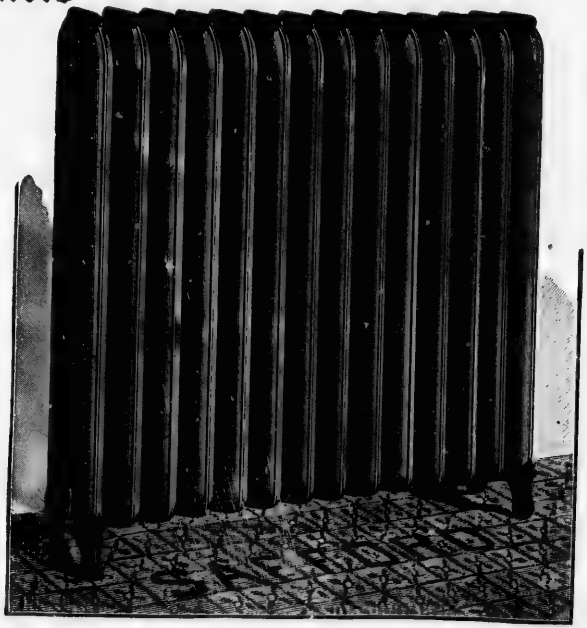
LIST OF SIZES

No. of Loops Long	Extreme Length, Inches	Heating Surface--Square Feet					Telegraph Code
		45 Inches High	38 Inches High	32 Inches High	26 Inches High	20 Inches High	
2	5	10	8	6⅞	5½	4	
3	7½	15	12	10	8	6	London
4	10	20	16	13½	10⅝	8	Lake
5	12½	25	20	16⅞	13¾	10	Lakefield
6	15	30	24	20	16	12	Laggan
7	17½	35	28	23⅝	18⅝	14	Lakeside
8	20	40	32	26⅞	21⅛	16	Lakeport
9	22½	45	36	30	24	18	Lakeview
10	25	50	40	33⅛	26⅛	20	Lambeth
11	27½	55	44	36⅝	29⅛	22	Lambton
12	30	60	48	40	32	24	Lanark
13	32½	65	52	43⅓	34⅛	26	Lancaster
14	35	70	56	46⅝	37⅛	28	Langton
15	37½	75	60	50	40	30	Lansing
16	40	80	64	53⅓	42⅛	32	Larkin
17	42½	85	68	56⅝	45⅛	34	Latimer
18	45	90	72	60	48	36	Laurel
19	47½	95	76	63⅓	50⅛	38	Layton
20	50	100	80	66⅝	53⅛	40	Lindsay
21	52½	105	84	70	56	42	Linton
22	55	110	88	73⅓	58⅛	44	Lisbon
23	57½	115	92	76⅝	61⅛	46	Listowel
24	60	120	96	80	64	48	Labo
25	62½	125	100	83⅓	66⅝	50	Lockton
26	65	130	104	86⅝	69⅛	52	Lombardy
27	67½	135	108	90	72	54	Longford
28	70	140	112	93⅓	74⅝	56	Longwood
29	72½	145	116	96⅝	77⅛	58	Loretto
30	75	150	120	100	80	60	Lothian
31	77½	155	124	103⅓	82⅝	62	Louise
32	80	160	128	106⅝	85⅛	64	Lovat
33	82½		132	110	88	66	Lucan
34	85		136	113⅓	90⅝	68	Lucknow
35	87½		140	116⅝	93⅛	70	Lundy
36	90		144	120	96	72	Luton
37	92½		148	123⅓	98⅝	74	Lurgan
38	95		152	126⅝	101⅛	76	Lyn
39	97½		156	130	104	78	Lynch
40	100		160	133⅓	106⅝	80	Lynden
41	102½			136⅝	109⅛	82	Lyndhurst
42	105			140	112	84	Lynn
							Lyons

Safford Radiators

Made into

Column, Semi-Circular,
Corner, Window,
or Stairway Radiators.
(To order.)

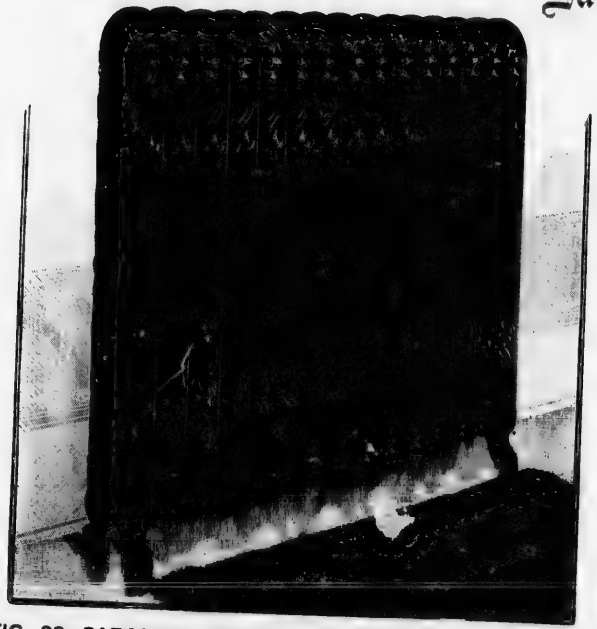


Prices and List of Sizes
same as on page 38.

FIG. 22—SAFFORD "PERFECT" RADIATOR (plain loops).
Made in following heights: 45, 38, 32, 26, and 20 inches. For Hot Water or Steam.

Sizes
38.

Made in
Column, Semi-Circular,
Corner, Window, or
Stairway Radiators.
(To order.)



Prices and List of Sizes same
as on page 38.

FIG. 23—SAFFORD "PROVINCIAL" PATTERN RADIATOR.
Made in following heights: 45, 38, and 32 inches.

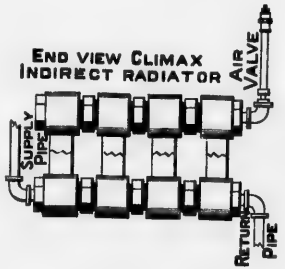
For Steam Only.

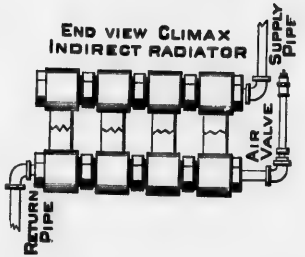
Safford Radiators

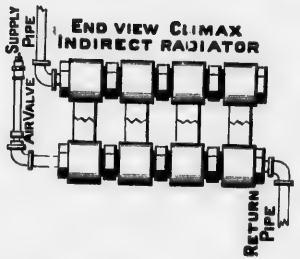
"Climax" Indirect Steam Radiators

Length, 36 inches. Height, 11 inches.
Width, 8½ inches.
Each section contains 13 square feet of Radiating surface.

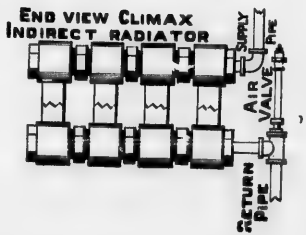
Fig. 24







The accompanying cuts show where the air valve should be placed on Climax Radiator, under different systems of piping.



All Climax Radiators are connected with Right and Left Hexagon Nipples.

Sections are always shipped loose.

Always break the small cast-iron strip connecting between the hubs, to allow for expansion of the section.

See Data, etc., page 42.

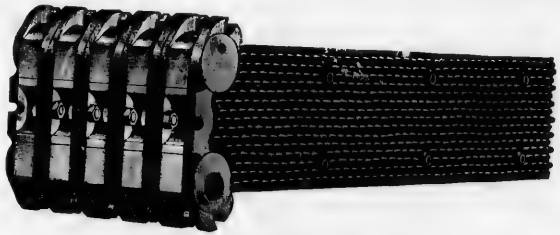
Price, $4.01 per section (13 sq. feet).

DATA FOR "CLIMAX" INDIRECT RADIATORS

Sections in Stack	Square Feet of Heating Surface	Area Cold Air Supply Square Inches	Area Hot Air Flue Square Inches	Size for Brick Work Hot Air Flues Inches	Size Register Inches	Ratio of 1 to 30	Ratio of 1 to 35	Ratio of 1 to 40
2	26	54	72	8 x 8	9 x 12	780	910	1040
3	39	72	96	8 x 12	10 x 14	1170	1365	1560
4	52	90	120	8 x 12	12 x 15	1560	1820	2080
5	65	108	144	12 x 12	12 x 19	1950	2275	2600
6	78	126	168	12 x 12	14 x 22	2340	2730	3120
7	91	144	192	12 x 16	14 x 24	2730	3185	3640
8	104	162	226	12 x 16	16 x 20	3120	3640	4160
9	117	180	240	12 x 20	16 x 24	3510	4095	4680
10	130	198	264	12 x 20	20 x 20	3900	4550	5200
11	143	216	288	12 x 24	20 x 24	4290	5005	5720
12	156	234	312	12 x 24	20 x 24	4680	5460	6240

Price List on Page 41.

Gold Pin Indirect Radiators



Stack of Gold Pin—INDIRECT.

. . DIMENSIONS . .

Each section contains 10 sq. feet surface.
Extreme length, 36 inches. Width, 11½ inches.
Width at connecting point, 15½ inches.
Each section occupies 2⅝ inches space.

NO POSSIBLE CHANCE FOR JOINTS TO SPRING.

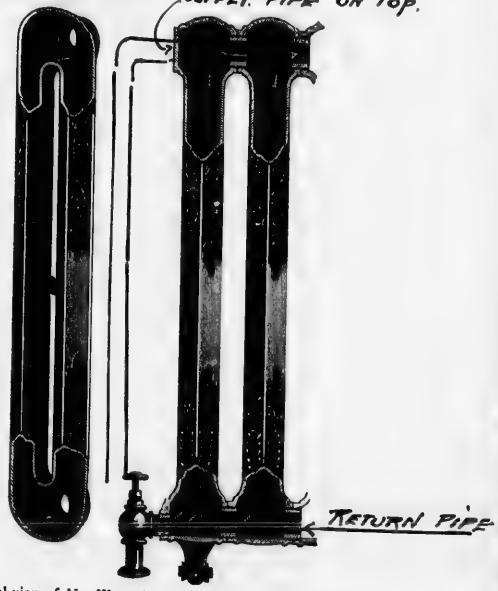
Price per section (10 ft.) $2 55
(Discount to trade.)

Fig. 25—Sectional View of Gold Pin—INDIRECT.

Sectional Views of Hot Water and Steam Radiators.

Sectional view of Steam Loop showing form of bottom NIPPLE CONNECTION.

No Bolts
Packing
Red Lead
Leaky Joints



Sectional view of Hot Water Loop showing form of top and bottom NIPPLE CONNECTION.

FIG. 26.

Read full description of above on pages 6 and 7.

Safford Radiator Valves.

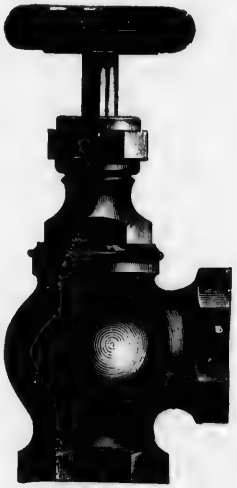


FIG. 27.

Best quality angle valves, wood wheels, and plated mountings.

Large Water-way.
Simplest in operation.

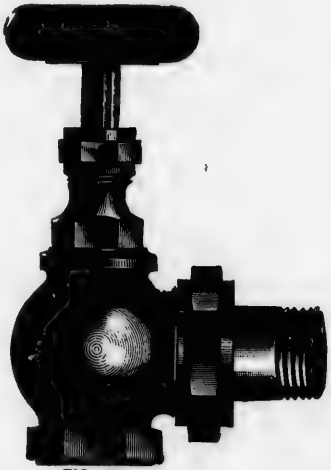


FIG. 28.

Fig. 27 represents Safford valve which we furnish with every Hot Water Radiator (according to terms of sale). This valve has wood wheel and is plated all over.

Fig. 28 represents Safford valve with union; this valve will be supplied, if desired, at additional cost of 67½ cents for 1 inch, and 82½ cents for 1¼ inch.

We recommend above valves because they are properly made and have full opening water-ways.

Valves tapped left hand will be furnished, when ordered, without extra charge.

We recommend valves tapped left hand to be used instead of Locknut Nipples; the latter are rarely ever made tight, and are tiresome to look at.

. . . Safford Radiator Valves . . .

FIG. 29—FULL VIEW.

Quick Opening Valve for Hot Water Radiators

Made with and without Unions
also tapped Left Hand to order

One-quarter turn of the handle opens or closes the passage, an arrow on the top of the handle indicating the position of the valve. The openings are of full area, with no obstruction to the free passage of water. Circulation is maintained at all times, thus obviating danger from freezing. The valve proper, or rotating disc, is practically a piston ring; therefore readily adjusts itself to any variation in size due to expansion and contraction, consequently the usual annoyance from this source is positively prevented. A simple mechanism rotates the valve disc, and the engagement with the top is such as to prevent any strain on the disc.

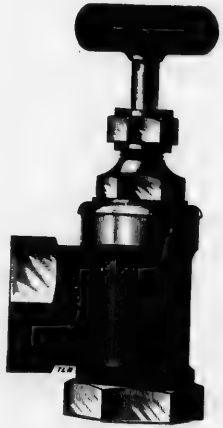


FIG. 29—BROKEN VIEW.
Showing disc inside.

The above Valve is only supplied to order, and at an additional price, to be quoted on application.

Radiator Air Valves

"Eureka" Automatic Air Valve

For Hot Water or Steam

Closes against water by a float without dripping.

Closes against steam by expansion without leaking.

FIG. 30—(For ⅛ pipe)

Easy to Apply.
Quick to Work.
Always Reliable.
Sensitive, Durable.
Requires no Attention.

Special Prices on Application.

Jenkin's Patent Air Valve

For Steam (Automatic)

FIG. 31—(For ⅛ pipe)
Plated or Plain.

Special Prices on Application

Compression Radiator Valve

For Hot Water

FIG. 32—(For ⅛ pipe)
Plated or Plain. Wood or Metal Wheels.

Cast Iron Floor and Ceiling Plates for Safford Radiators.

Double Floor Plate for Twin Connection Radiators.

FIG. 33.

FIG. 34.

Ceiling Plate with Set Screw.

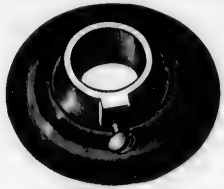


FIG. 37.

Single Plate for Single Connection or One-Pipe Radiators.

FIG. 35.

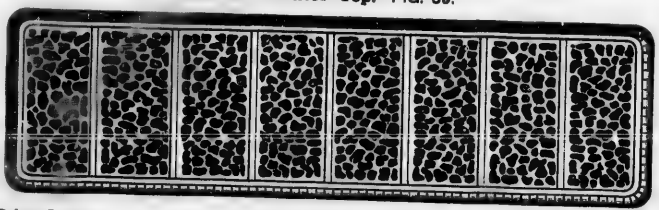
FIG. 36.

Sizes, inches	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	1 x ¾	1 x 1	1¼ x 1	1¼ x 1¼
Figs. 33 and 34, plain, price each						$ .15	$ .15	$ .15	$ .15
Figs. 33 and 34, plated, price each						.30	.30	.30	.30
Figs. 35 and 36, plain, price each	9	9	12	15	19				
Figs. 35 and 36, plated, price each	15	15	18	21	25				
Fig. 37, plain only, price each	15	15	18	21	24				

Hexagon Nipple.

FIG. 38.

Safford Radiator Top.—FIG. 39.



Bushing.

FIG. 40.

Plug.

FIG. 41.

Price, Plated—4 loop Radiator tops, 40 cents per section extra: 2 loop Radiator tops, 30 cents per section extra. Tops made to suit Radiators, Figs. 1 to 18.

Figs. 38, 40, and 41 quoted on application.

General Instructions.

"Favorite" and "Daisy" Patterns.

Width of 2 loop, 6 inches. Width across feet, 6½ inches.
Width of 4 loop, 8 inches. Width across feet, 8½ inches.
Distance from centre of inlet to floor line,
Single connection, 8⅞ inches. (Double or) Twin connection, 8½ inches.

"Perfect" and "Provincial" Patterns.

Width of loop, 7¼ inches. Width across feet, 9¼ inches.
Distance from centre of inlet to floor line,
Single connection, 8½ inches. Double connection, 8½ inches.

Hot Water Radiators.

Radiators containing 48 square feet and under, 1 inch.
Radiators containing over 48 square feet, 1¼ inch.

Steam Radiators.

Radiators containing 48 square feet and under 1 x ¾ inch.
Radiators containing over 48 square feet, 1¼ x 1 inch.

All Radiators will be shipped as above, unless otherwise ordered.

All Radiators are tapped right hand, excepting those with double connections on same end, which are tapped left.

. . . Telegraph and Cable Code . . .

In ordering by WIRE, we suggest the use of the following Code. It will save expense, and lessen liability for mistakes to occur.

Cable and Telegraph Address:

"Radiator," Toronto, Ont.

MISCELLANEOUS

Ship by freight ..... Hurry
" express ..... Haste
Add to our order of — inst. ..... Hungry
When will order be shipped? ..... Help
Change order of — inst. to read ..... Haphazard
Quote lowest prices on ..... Hack
Steam Radiators ..... Hot
Hot Water Radiators ..... Humid
Quote freight rates on car load of Radiators .. Heavy
Quote freight rates on less than car lot of Radiators ..... Hail
Ship via Canadian Pacific Railway ..... Hamlet
" Grand Trunk Railway ..... Handy
" Northern and North-Western ..... Highest
" lake and rail ..... Hated
" steamer ..... Holiday
How soon could you ship? ..... Humming
Ship all you can now, balance soon as possible ..... Hindered
—— order booked, specification will be sent early as possible ..... Hit
Has order been shipped? Wire reply ..... Hamper
Book order for ——feet ..... Habitual

TAPPING

⅜ x ⅜ ..... Small
1 x ⅜ ..... Size
1 x 1 ..... Simple
1¼ x ⅜ ..... Stood
1¼ x 1 ..... South
1¼ x 1¼ ..... Song
1½ x 1¼ ..... Sold
1½ x 1½ ..... Sure
2 x 2 ..... Safety

STYLE OF CONNECTIONS

Top feed pipe and bottom return on same end ..... Shabby
Top feed pipe and bottom return on opposite ends ..... Sever
Single connections at opposite ends ..... Suitable
Twin connections ..... Saving
One pipe for Steam ..... Seldom

QUANTITY

250 feet ..... Angle
500 " ..... Angular
750 feet ..... Ankle
1000 " ..... Anatomy
1500 " ..... Anapest
2000 " ..... Annex
2500 " ..... Answer
3000 " ..... Antagonist
3500 " ..... Antedate

HEIGHTS AND WIDTHS

20½ inch Steam ..... Muster
26½ " " ..... Mix
32½ " " ..... Medium
38½ " " ..... Monarch
42½ " " ..... Moment
2 loop " ..... Meter
4 " " ..... Motor
20½ inch Hot Water ..... Malleable
26½ " " " ..... Machinery
32½ " " " ..... Mitre
38½ " " " ..... Mistitle
42½ " " " ..... Mistook
2 loop " ..... Mystic
4 " " ..... Mistake

Directions for Decorating

ONE of the many advantages the "Safford" has over other Radiators is that the artistic design of the ornamentation, and its particularly convenient shape for decorating, renders it possible to obtain an extremely rich and beautiful effect by finishing in combination of different colored bronzes, so that at a reasonable expense the Radiator can be made to correspond and harmonize with its surroundings, even the most costly and elegant.

We therefore submit the following directions, which can be easily and simply execut[illegible] First, give the Radiator a coat of paint, properly mixed, so that it will stand the heat; and when dry go over the **entire surface** of the loops with **Bronze Liquid,** after which apply the **Dry Bronze** with an ordinary camel's-hair brush.

The advantages derived are many by putting on the bronze **dry.** You obtain a much better lustre; it will last longer, and takes much less material.

After the first coat of bronze is thoroughly dry, go over the **raised ornamentation** with bronze liquid, using wide, flat brush, making it very easy to touch **only the ornamental part,** and then apply dry bronze in **different color** from first coat, of course selecting for this a color that will harmonize with the body or first coat.

If these directions are carefully followed, an extremely rich and elegant finish is obtained.

We mention the following combinations as being particularly effective, viz.:

Silver body with copper on ornamental part.
Copper body with silver on ornamental part.
Copper body with gold on ornamental part.
Blue-green body with gold on ornamental part.

Other combinations will suggest themselves by the finish and surroundings of the apartment where the Radiator is placed.

Blue-green, fire, lemon, and lilac bronzes also make rare and beautiful combinations.

We keep constantly on hand a stock of first-class bronzes and liquids, and shall be pleased to quote prices and send sample card of colors on application.

The Powers Automatic Temperature Regulator

PATENTED OCT. 19th, 1889, and MAY 12th, 1891.

A Non-Electric Regulator for Controlling Temperatures

Absolutely Automatic. Used with any Heating Apparatus. Applicable to all purposes where it is desired to maintain a Uniform Temperature.

Secures Uniform Temperature.—It automatically controls the draught to ANY HEATING APPARATUS; THE TEMPERATURE OF THE HOUSE ITSELF furnishing the motive power to operate the dampers.

Used with a Hot Water Plant, it adds 15 PER CENT. TO THE HEATING POWER, and prevents it from BOILING OVER.

Low Pressure Steam.—It keeps the steam down whenever the house is at the right temperature, and absolutely prevents overheating.

Hot Air Furnace.—It perfectly controls the draughts, and gives the best results that are possible with the apparatus.

It Saves Fuel, by maintaining an even, steady fire, and never overheating the house. No clinkers are formed, and the coal all burns to ashes.

Hot Water Tanks in Asylums, Hospitals, and Hotels.—It automatically controls the temperature of water for household purposes, heated in tanks, either by steam or hot water heaters.

Steam Distributing Plants, Offices in Factories, Etc.—It perfectly controls the temperature of residences, offices, or shop rooms when heated by steam discharged through a trap.

Used for all places where it is desired to limit the temperature at any certain point.

- - - Manufactured by - - -

The Toronto Radiator Manufacturing Co., Ltd.

TORONTO - ONTARIO

BRANCHES:

Montreal, Que. Quebec, Que. St. John, N.B. Hamilton, Ont. Winnipeg, Man. Victoria, B.C.

Powers Regulators

DESCRIPTION OF

The Powers Vapor Thermostat

The Thermostat is here shown in a front and side view, in section, showing interior construction, parts being cut away. It consists of a disk twelve inches in diameter and one and one-quarter inches in thickness at the centre.

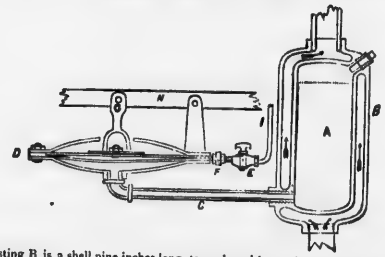
It is made of heavy sheet brass of antique finish, and has inside a metallic diaphragm which divides it into two separate compartments. This diaphragm is corrugated to give it elasticity, and travels easily from one side to the other. In one compartment, hermetically sealed, is placed a liquid which boils at 90 degrees, forming steam in the same way that water does at 212 degrees. When cold, this fluid condenses and forms a partial vacuum in the chamber, and the diaphragm is forced over closely against the front or smooth wall of the Thermostat by the pressure of the air on the other side.

The Thermostat is hung upon the wall of a central room, as shown on page 54. Connected with the space back of the diaphragm is a small lead pipe which leads down inside the partition, and connects with the chamber, D, on the diaphragm at the heater, shown in detail on page 56.

DESCRIPTION OF

The Powers Hot Water Regulator

Patented September 10, 1889.



The casting B is a shell nine inches long, tapped at either end to receive a two-inch pipe, and containing within a second shell, A, called the supplementary boiler or steam generator. This is called the generator, and is placed in one of the flow pipes immediately above the boiler (as shown on page 56), and the water circulating through it between the two shells heats the inner one.

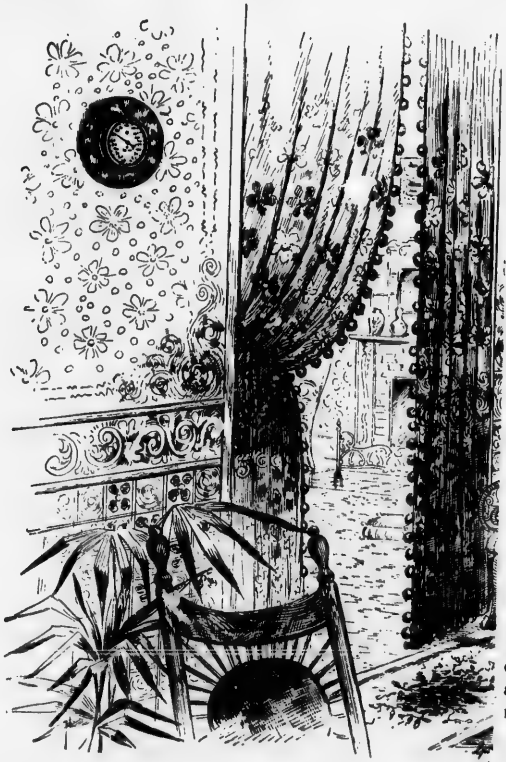
When the flow pipe is larger than two inches, a tee should be put in and a return run to the bottom (as shown on page 55), placing the generator in the return as near as possible to the flow pipe and heater. This pipe may be 1¼ inch, using bushings in the generator.

When used to limit a hot water heater, the inner shell of the generator contains water, entirely separate from that in the heater. A tube, C, leads from the generator to and supports the diaphragm casting, with the usual piston resting on the rubber sheets and lever connected with the damper and check draught, the same as in a steam heater. The diaphragm is held down, except in the No. 1, by a steel spring, the tension and resistance increasing as it is forced up.

The generator A is supplied with water through the plug at the upper right hand corner, as shown in the cut. Being hermetically sealed, the water can never escape. This water, being under atmospheric pressure only, boils at 212 degrees. The water of the heating system is under added pressure, due to the height of the column of water up to the expansion tank.

It is a well-known law that the boiling point of liquids varies as the pressure upon their surfaces increases or diminishes. Thus the water in the generator will begin to boil at 212 degrees, while that in the boiler, where the expansion tank is twelve feet above, will not boil until about 225 degrees is reached.

As soon as the temperature of the circulating water rises above 212 degrees, steam begins to form in the supplementary boiler, and pressing the water out through tube C raises the two rubbers and lever, and closes the damper. The fire is at once checked and no steam can form in the heater, as its boiling point has not been reached. When the temperature falls below 212 degrees, the steam condenses, and the damper opens. So, as long as the fire is kept up, the heat will remain constant at about 215 or 220 degrees. To secure action at different temperatures for special work, liquids having appropriate boiling points are used in the generator.



The Powers Thermostat

The accompanying cut shows the Thermostat as it appears on the wall with the Thermometer on its face. It is nearly twelve inches in diameter, and one and a quarter inches thick, and being handsomely finished in antique brass is very ornamental in appearance. The Thermometer is fastened upon the Thermostat by the open leaf and scroll work which passes over and behind the edge of the Thermostat on the lower side, while the top is held by a small screw which turns down behind the Thermostat. They are easily removed, and can be attached to any Thermostat which we have heretofore sent out.

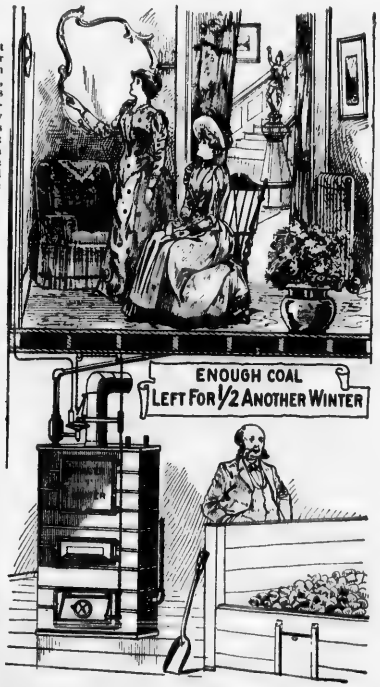
The Thermometer is six inches in diameter. By it the temperature can be read from any part of the room.

A Heater equipped with this Regulator becomes a

Living
Breathing
Creature
Endowed with
Intelligence

It knows enough to shut the Damper when the house is comfortable, and to open it when it begins to get cold.

A heating apparatus that knows when it has done enough, and holds its breath, and so saves the fire until more is needed.



Powers Automatic Temperature Regulator

As used with hot water, showing the Thermostat on the wall and the lead pipe running down inside the partition, connecting with the diaphragm at the heater.

Powers Regulators

No. 5 Regulator for Hot Water

Double Lever Attachment

Applied to No. 4, making No. 5.

TELEGRAPH CIPHER, ULSTER.

No. 5 Regulator and Thermostat complete for Two Heaters . . . . $42.00.

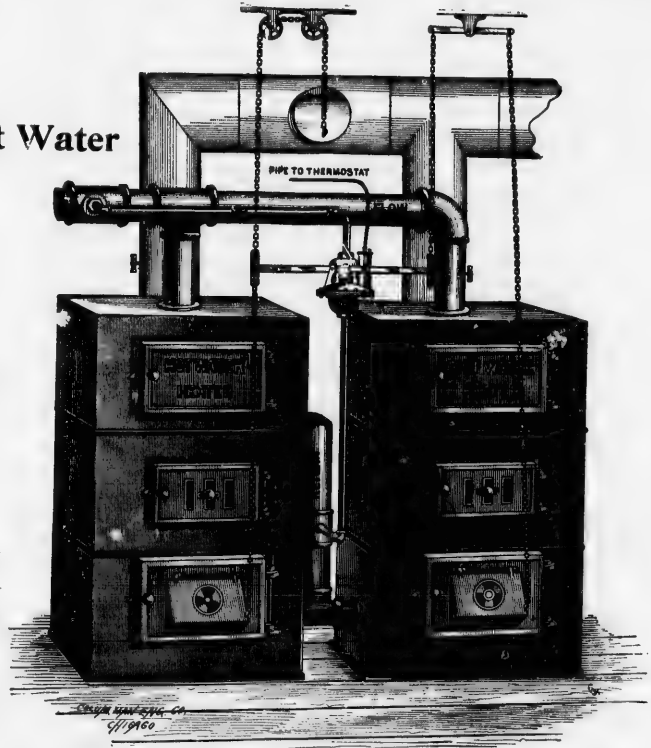
We illustrate above the Double Lever Diaphragm designed for the control of twin heaters, as shown on this page. A special lever is used above the other, by which the second damper is operated.

By detaching the plate of either one the other can be used singly.

This **Double Lever** can be added to any of the diaphragms, and the regulator will control two sets of dampers, provided they are **light. It will not** satisfactorily operate dampers, either single or double, that are too large or too heavy. Dampers should not weigh over five pounds.

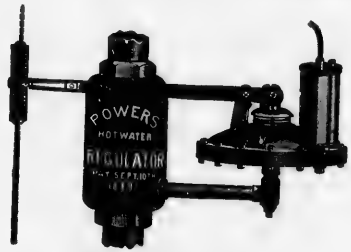
The return may be run in any way that will secure a free circulation through it. Care must be taken that there is no trap in the pipe by which it may become air-bound and thus stop the circulation. Where a number of feet of pipe intervene between the heater and the generator, it should be wrapped to prevent loss of heat while the water is passing through it.

Never put the Generator in a return from a Radiator. The full heat of the boiler must be in the Generator.



—55— **The Powers Regulator, as used on Double Hot Water Heaters.**

No. 4 Regulator for Hot Water



TELEGRAPH CIPHER. UNICORN.

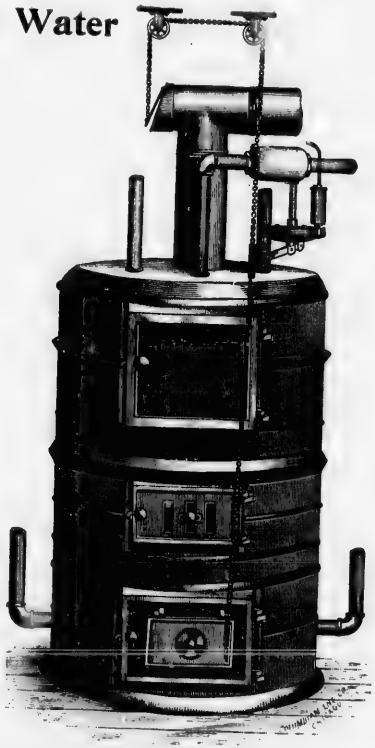
No. 4, Complete, with Thermostat . . . . . $40.00.

The Number 4 Diaphgram and Generator is shown in the cut above, and also on the two preceding pages in position, as used on a hot water heater where there is a flow pipe of two inches or less in which the generator can be placed.

On page 12 the generator is shown located in a horizontal pipe, which is sometimes necessary where the basement ceiling is low and there is not room for it in the vertical pipe. In such cases the diaphragm may be inverted and hung directly under the generator, or it may be placed at some distance from the generator, using nipples and elbows to bring it to the desired position. In such cases it may be used either side up, but care must be taken to support it, either by hangers from joists above or otherwise, so that it will remain firm where placed. In this way it may be located several feet distant from the generator. The brass chamber is reversible, and can be used on either side of the diaphragm by changing the plug in the ring connection.

Where the flow pipe is larger than two inches the generator is connected as shown on page 55 on page 53. The hot water flows through the generator and imparts its full heat to the interior shell or supplemental boiler, where the steam is formed, to close the damper when near the boiling point. The small tube is shown on page 7, running along the ceiling to connect with the thermostat above, which affords a pressure generated by the heat of the house, and which keeps the dampers in just the right position to do the work required. The check draught is also shown, connected to the lever, so that it opens when the draught damper closes, thus securing perfect control of the fire. The check draught is an important feature, and is shown in different forms and sizes on page 61. **It should never be omitted.**

Without this regulator, it is not practicable to carry a temperature of more than 185 degrees in a hot water heater, for fear it will boil over in the fluctuations likely to occur, unless very carefully watched, and so all the radiation has heretofore been based upon this temperature of the water. The regulator raises the limit to 220 degrees, adding fully 15 per cent. of heating power to the radiators, the effect of which is very apparent as well as agreeable in severe weather. The main objection that has been alleged against hot water heating disappears when this regulator is used, namely, the time it takes to heat the house on cold mornings. With the regulator the house **never gets cold,** the temperature being the same morning, noon, and night, if the fire is kept supplied with fuel and clean.



HOT WATER REGULATOR

As used with Generator in Horizontal Pipe with Diaphragm Inverted.

Powers Regulators

The No. 3 Regulator

As used with Low Pressure Steam.

TELEGRAPH CIPHER, DEXTER.

No. 3, Complete, with Thermostat . . . . . $35.00.

The above cut represents the No. 3 Diaphragm which is used in connection with the Thermostat, as shown on preceding page, to control a Low Pressure Steam Apparatus.

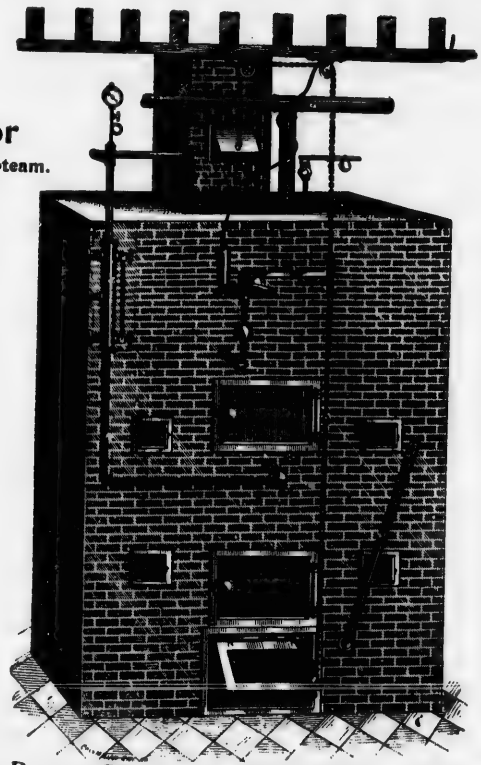
It is connected below the water line in the same manner as the ordinary Diaphragm, and serves the same purpose, that is, to limit the steam at the desired pressure. Both rubbers are raised by the steam, while the pressure from the Thermostat raises the upper one only, as described on page 58.

Whenever the house reaches the temperature to which the regulator has been adjusted, the damper is closed by the action of the Thermostat whether there is any steam in the boiler or not. In all ordinary weather no steam will be indicated on the gauge, a light vapor filling the radiators and maintaining a uniform temperature, the result being a **great saving of fuel.**

A house cannot be overheated in ordinary winter weather with a steam plant when left to the control of this Thermostat.

A temperature as low as 60 degrees can be secured at night, although the best and most economical way is to maintain the same temperature during the night in the main rooms of the house, closing the valves in sleeping rooms if desired. In this way a comfortable house in the early morning is assured, and no more fuel is burned than would be required to bring the temperature up if allowed to run down during the night. All who have adopted this plan agree as to its economy.

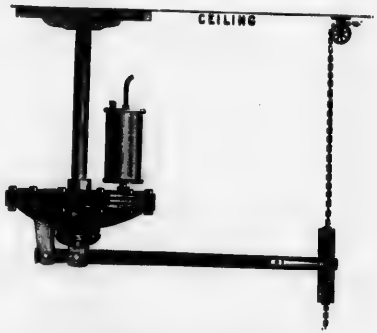
With this Regulator on a steam plant, it is very important to have **good Automatic Air Valves** on all the radiators. Without them good results cannot be obtained. We can furnish Valves that are reliable, if desired.



The Powers Regulator—On a Low Pressure Steam Heater controls both the steam and the house temperature.

The No. 2 Regulator

As used with a Hot Air Furnace.

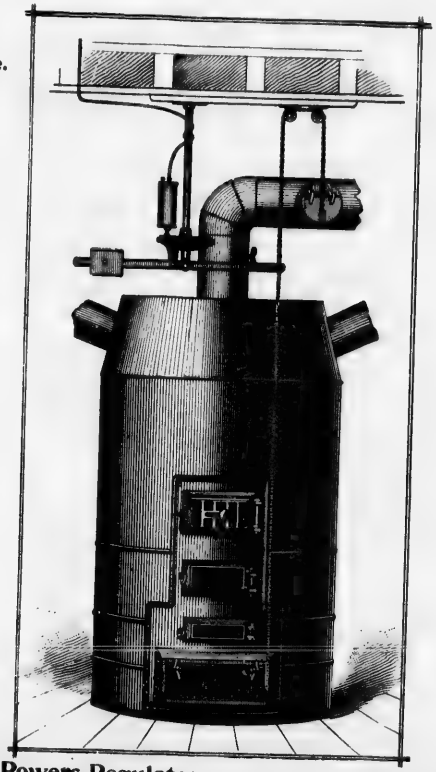


TELEGRAPH CIPHER, ATLAS.

No. 2 with Thermostat, complete, price . . . $30.00.

The No. 2, as shown above and in position opposite, controls the dampers of a **Hot Air Furnace.** The diaphragm is inverted for convenience in hanging, and is supported from a flange attached to a board on the ceiling by means of a short piece of iron pipe. It is placed in any convenient position, so that the end of the lever comes over the damper. The check draft is also connected by means of a chain and pulleys. **All these parts and everything necessary to put up the apparatus are furnished with every outfit,** including thirty-five feet of lead tube with which to connect the thermostat.

With a hot air furnace there is but one thing to do, that is, close the damper when the house is at the right temperature, and open it when more heat is needed. Hence the duplex feature of the regulator is not used as with steam and hot water, both of which require limiting at a certain point, without any regard to the temperature of the house. With this **Regulator,** a good hot air furnace gives very perfect results, and a great saving of fuel is effected. As long as coal is supplied and the grates kept clean, a uniform temperature will be maintained without any care of the dampers, provided the apparatus is capable of doing it. We do not claim to be able to give perfect results where the heating system itself is deficient or poorly proportioned; all we can do is to bring out with the regulator the best results that are possible to the apparatus. There is less danger from fire, and the house can be safely left alone for hours at a time, or over night, with a good fire, knowing that the regulator will take perfect care of it during your absence.

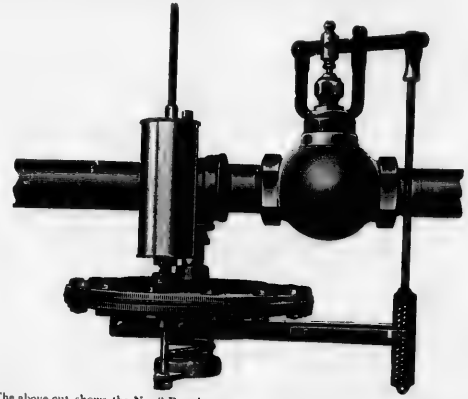


 The Powers Regulator—As used with a Hot Air Furnace

Powers Regulators

The Powers Regulator, No. 6

For Automatically Controlling the Temperature of Residences or Offices when heated by Live Steam, Drained through a Trap.



The above cut shows the No. 6 Regulator applied to a balanced valve located in the steam supply pipe.

The diaphragm is here shown attached by a solid plug to a fitting in the pipe, for support only, making a very convenient and permanent arrangement. It may, however, be suspended from the ceiling either above or below the valve by means of a flange and nipple, as shown on page 58.

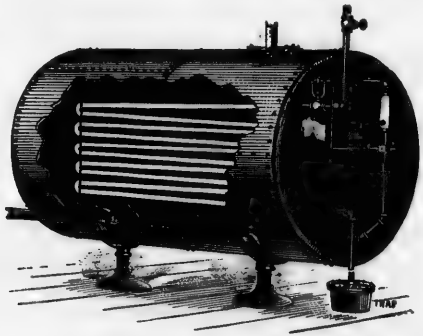
The Thermostat located above in the rooms to be heated perfectly controls the valve, admitting only what steam is required to maintain the desired temperature. It is applicable to **Residences heated from a Steam Distributing Plant,** giving the best of results, both in economy and comfort.

It also used in offices in manufacturing establishments where steam is taken from the boiler through a reducing valve and drained into a trap. For this purpose **it is invaluable.**

The Powers Regulator

For Controlling the Temperature of Water Heated by Steam in Tanks.

Used in Hotels, Hospitals, Asylums, and Public Institutions of all kinds.



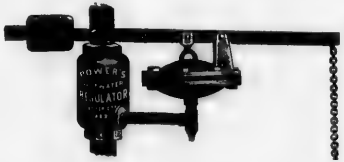
Uniform temperature is secured at any desired point, and a constant supply of properly-heated water is always on hand. **No danger of scalding.**

The Generator is located in a circulation pipe as shown above, connected a little below the top of the tank and returning into the bottom. The operation of the Generator in described on page 58.

The inside shell of the Generator is nearly filled with water, and above the water is placed a gill of gasoline, benzine, or kerosene, as desired, these different fluids having boiling points varying from 120 to 180 respectively. A temperature about 10 degrees higher is secured in the water, the balanced valve being closed by the vapor pressure formed from the fluid whenever the temperature reaches its boiling point.

The No. 1 Limiting Device

For the Control of Hot Water Heaters and Steam Supply Valves.



TELEGRAPH CIPHER, AGATE.

No. 1, Limiting Device only, price . . . . . $18.00.

The cut above represents the No. 1 or Limiting Device. Used to control hot water heaters at a certain definite temperature, usually the boiling point of water. Also to control at any desired temperature water or other liquids when heated by steam coils in tanks, as shown on page 59.

On the preceding page it is shown attached to a heater used in connection with a tank containing water for household purposes.

In apartment buildings, hotels and public institutions, where large quantities of hot water are required, it is a valuable and necessary appliance.

Without automatic control, the water is either too hot or too cold a great part of the time, and very close attention is required to maintain any degree of uniformity.

With the Regulator, a constant supply of hot water is assured, no matter how little or how much is used, with the least possible consumption of fuel.

All danger of boiling in the tank is obviated, and the noise and the objectionable steaming of overheated water when drawn in the house is entirely prevented. It can be made to operate at different temperatures by the use of liquids, with different boiling points, in the Generator, as described on page 59.

The principle of its operation is fully described on page 58.

The No. 1 may be used on any hot water heating plant to prevent boiling over. It will enable a high temperature to be carried in cold weather when desired, and add a great deal to the efficiency of the apparatus.

The No. 1, however, has no control over the house temperature, and must not be confounded with the No. 4, which not only limits the heater at the boiling point, but also maintains a uniform temperature in the house.

The No. 1 may be attached to a balanced valve, for the automatic control of steam supplied to a coil for heating water in a tank, and perfect control thereby secured. We have many in operation in public institutions, giving the best of satisfaction. This application is shown on page 59.

The Powers Regulator—As used to control a Hot Water Boiler

No. 1 Draught.

No. 2 Draught.

No. 3 Check.

No. 4 Check.

No. 5 Check.

LIFTING DRAUGHT AND . . CHECK DAMPERS

These Draught Dampers are made to bolt on to the ordinary slide in the ash-pit door, the joint between being filled with stove putty. They are made in different sizes and will fit any flat surface. Where there is no opening in the door, one should be made by drilling out a piece of the right size. Where the door is curved, we can furnish them to fit approximately if a paper pattern is sent showing the size and shape and curve of the face on which the damper is to go. If they do not fit very closely they can be made tight with putty, which soon hardens. The damper need not be of length sufficient to cover the full openings in the ash-pit door, as one or more of the holes in the slide can be permanently covered by a piece of sheet iron bolted on.

It is necessary to cover in this way the opening in the slide next to the handle where it is made to turn in opening the door. Without this the damper and the handle will interfere with one another in some cases.

The check draughts No. 3 and No. 4 are made to fit inside of an eight-inch thimble, which can be put on any sized pipe at the place desired by a tinner.

The No. 5 Dampers go on the outside, and are made to fit all sizes of pipe from 6 to 12 inches.

There should always be a check draught opening outward, and of similar pattern to these. **Never connect** the regulator with **any inside turning damper. Good, light, easy-working** dampers are of **vital importance to its success.**

No. 1.

4 inches by 6 inches	Price,	$1.00 each.
4 " 8 "		
4 " 10 "		
6 " 6 "	"	$1.25 "
6 " 8 "		
6 " 10 "		
6 " 12 "		

No. 2.

5 inches by 12 inches..... Price, $1.00 each.

Nos. 3 and 4.

8 inches diameter..... Price, $1.00 each.

No. 5.

For 6, 7, 8, and 9-inch pipe	Price,	$1.00 each.
" 10 and 12 "	"	1.25 "

Questions Often Asked

Will it operate on a hot water heater?
Will it work on a hot air furnace?
Will it control low pressure steam?
How long has it been in use? Four years.
Is it an electrical apparatus? No.
Is it likely to get out of order? It is not.
Do you guarantee it? We do, fully.

YES.

Will the Thermostat lose its energy? It will not. Any one that fails within five years we will make good if returned to us.

How long will the rubber diaphragm last? Many years; we will furnish new ones free in place of any that fail in five years.

Do you send them on trial to be paid for if satisfactory? Yes, to responsible parties anywhere in Canada. The efficiency of the regulator can be demonstrated, when put up, at any time of the year by proving tests described in the directions.

Can I put it up myself? Yes, if you are anything of a mechanic, and will **read** and **follow** the directions. They are very explicit.

Are they complicated? No; they are simple in construction, and can be put up by any person of fair mechanical skill.

Do you make a discount? We prefer to handle them through the heating trade, and to it we allow a discount from the list price sufficient to enable them to be put in operation at the price given, if done when the heater is put in.

Do you furnish lifting dampers? Yes, but they must be paid for extra.

Price List of Powers Automatic Regulators

Telegraph Cipher.

Agate.	No. 1.	Limiting Device only, for Hot Water Heater	$18 00
Atlas.	No. 2.	Regulator complete, for Furnace	30 00
Dexter.	No. 3.	" " " Steam	35 00
Unicorn.	No. 4.	" " " Hot Water	40 00
Ulster.	No. 5.	" " " two Heaters	42 60
Valor	No. 6.	" " " Steam Valve	30 00

The Latest Invention

Kieley's Steam.. Trap....

AND

Steam Heating Specialties

All Patent Rights and Manufacturing controlled by

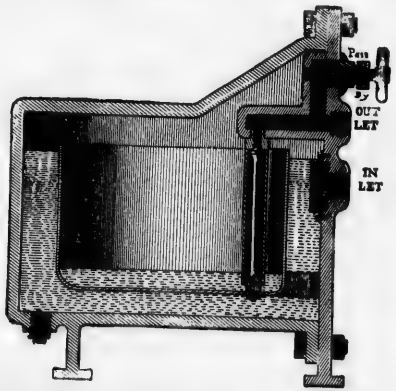
The Toronto Radiator Mfg. Co., Ltd.

Toronto, Ontario

Montreal, Que.
Quebec, Que.
St. John, N.B.

Hamilton, Ont.
Winnipeg, Man.
Victoria, B.C.

Kieley's Standard Steam Trap



For Automatically drawing the Condensation from all kinds of Steam Apparatus, independent of returning it to the boiler.

PRICE LIST AND SIZES.

Number	1	2	3	4	5
Inlet or Outlet	¾ in.	1 in.	1¼ in.	1½ in.	1½ in.
Number of lineal feet of in. Pipe Trap will drain.	4,000	6,000	10,000	15,000	25,000
Prices	$18.00	$30.00	$45.00	$60.00	$80.00

Kieley's Standard Steam Trap

THE construction of the steam trap (shown by accompanying cut) is such as to cause it to work satisfactorily under a pressure of 100 pounds or more.

The float, being an open one, prevents all danger of it ever collapsing; and, being hinged to the cover, its power is increased to three or four times that of all open floats used in drain traps heretofore.

All the working parts are fastened to the cover, to which are also connected the inlet and outlet pipes. The result is, that by simply unbolting the body of the trap and moving it back, all the working parts can be seen in exactly the same position as they are when the trap is working. The inlet and outlet pipes, being connected to the cover only, admits of this trap being taken apart and cleaned without disconnecting a single pipe.

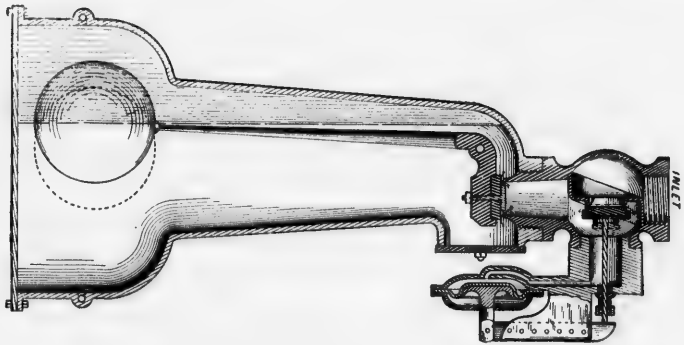
The pass-by, when open, will allow the air and water to pass out of or through the trap independent of the opening controlled by the float—which is of great advantage, outside of avoiding the otherwise necessary cost of a valve, pipe, fittings, and labor in making a pass-by.

In ordering, if possible, state whether for high or low pressure.

If you want to drain the condensation from any kind of steam apparatus, independent of returning it to the boiler, specify the STANDARD STEAM TRAP.

Kieley's Combined Pressure Regulator and Water Feeder

Most Perfect Apparatus in the Market.



Price, $50.00

Combined Pressure Regulator and Water Feeder

More or less trouble has been experienced with most Water Feeders used on house-heating and other boilers depending upon the pressure upon the street main to force the water into them. This has been due mainly to the valve in the water feeder becoming stopped up with dirt deposited by the water, which generally occurred during that part of the season in which the boiler was idle. Especially has this been the case where the pressure on the street main is very high, and where it was therefore necessary to have a water feeder with a very small valve, so as to enable the float to close it against the excessive high pressure.

This trouble is entirely overcome by the Combined Pressure Regulator and Water Feeder. The area of the valve in this Water Feeder is equal to that of the pipe, which entirely prevents all chances of it ever becoming stopped up with dirt. To make it possible for the float to close so large a valve, it became necessary to bring about a reduction in the water pressure, and yet allow sufficient pressure to cause the water to enter the boiler. This is done automatically by the pressure regulator, through which the water must pass before it can enter the water feeder, thus holding back the excessive high pressure so that the valve in the water feeder will have to close against a properly reduced pressure only.

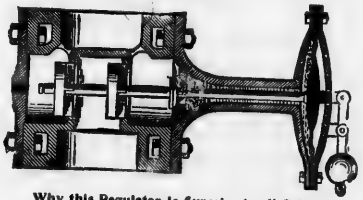
Connect the water feeder to boiler the usual way. Connect water pipe to inlet end of regulator. The little valve on side of casting, when screwed in as far as it will go, closes the channel between the low pressure side of regulator and the diaphragm, and at the same time releases the pressure under the diaphragm so that the pin in the variable fulcrum can be moved. In this condition the regulator allows the full pressure to pass. It is consequently necessary to back the little valve out as far as it will go, in order to cause the regulator to reduce the pressure.

The regulator should be set to give from 5 to 10 lbs. more pressure than it is intended to carry on the boiler. To do this, connect pressure gauge to ¼ outlet opposite the little valve, first having placed the fulcrum pin in the hole nearest the inlet end of regulator. Then turn on the water and allow the boiler to fill until the water feeder closes, after which consult the pressure gauge. If it does not show 5 to 10 lbs. more pressure than it is intended to carry on the boiler, move the pin one hole closer to the diaphragm, and keep on doing this until the reduced pressure is sufficiently high to cause the water to enter the boiler against the pressure it is intended to carry thereon.

Improved Eureka Pressure Regulating Valve

For Reducing Pressure on all kinds of Steam Heating Apparatus.

(KIELEY'S PATENT)



Why this Regulator is Superior to all Others.

1st. Because the Diaphragm is made of the most flexible and durable material in the market.
2d. Because the Disks of the Valve are so made as to produce a perfectly-balanced Valve, which has not been accomplished heretofore.
3d. Because it has no waste pipe to cause extra waste of steam and water.
4th. Because it has no springs to get out of order.
5th. Because it gives the full area of the pipe.
6th. Its great simplicity, there being no complicated parts to get out of order.
7th. Because it makes less noise than any other Valve made.
8th. On account of its flexible diaphragm, accurately balanced Disks, nicety of adjustment and great area of Diaphragm, it is the best and most sensitive Pressure Regulating Valve made.

DIRECTIONS FOR CONNECTING.

Connect end of valve marked "Inlet" to the high pressure. Have the diaphragm underneath, so as to allow the water of condensation to remain on it, and also to prevent steam from coming in contact with it. Connect the short or sloted end of lever to the two lugs extending down through centre of diaphragm, so that the two lugs extending down from the casing become the fulcrum. To adjust the weight so that the valve will give the desired pressure, move it in or out as the case may demand until the desired pressure is obtained, after which fasten the weight to the lever by setting up on the thumb-screw.

PRICES AND DIMENSIONS.

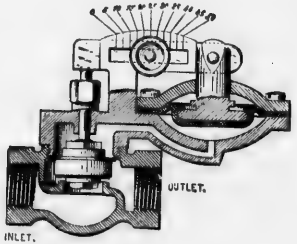
Size of Valve	1	1¼	1½	2	2½	3	4
Diameter of Flanges					7	8	10
Distance, face to face of Flanges					7	8	10½
Prices	$22	$28	$35	$44	$57	$72	$100

Size of Valve	5	6	7	8	9	10	12
Diameter of Flanges	11	12	13	14		16	18
Distance, face to face of Flanges	11½	12½	13½	14½		16½	18½
Prices	$135	$180	$225	$275	$350	$350	$470

KIELEY'S Patent Pressure Regulator

Constructed especially for

Regulating Water Pressure

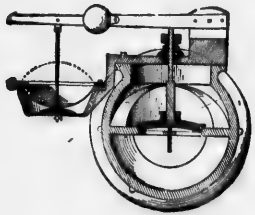


The high pressure enters the valve at the end marked "Inlet," then passes through between the seat and disk and through the channel to the diaphragm chamber. When the desired pressure has been obtained it causes the diaphragm to move upward, which movement is conveyed through a lever to the valve, causing it to close, thus allowing only the desired portion of the initial pressure on the reduced side. The variable fulcrum enables one to carry any desired portion of the initial pressure, and the figures thereon show pretty accurately where to place the pin to get the desired pressure.

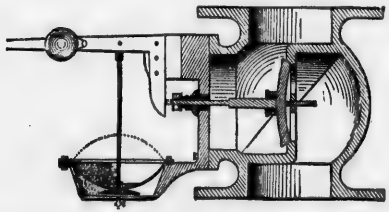
PRICE LIST.

¾ in.	$20 00	4 in.	$100 00
1 in.	22 00	5 in.	135 00
1¼ in.	28 00	6 in.	180 00
1½ in.	35 00	7 in.	220 00
2 in.	44 00	8 in.	250 00
2½ in.	57 00	9 in.	350 00
3 in.	72 00	10 in.	360 00
12 in.	$470 00		

Kieley's Patent Back Pressure Valve



The above is a Sectional View of Back Pressure Valve for Horizontal Pipe.



The above is a Sectional View of Back Pressure Valve for Vertical Pipe.

The accompanying views are sectional cuts of Kieley's Patent Horizontal and Vertical Back Pressure Valves. The cuts give a very correct idea of the construction of these valves. Their action is entirely noiseless, though effective. In this we would advise the use of valves for horizontal pipe.

Where exhaust steam is mingled with live steam for heating purposes, a *sensitive*, and, at the same time, a *tight* and *reliable back pressure valve* becomes a very important factor, since a leaky and unreliable valve will allow the live steam, with the exhaust, to escape to the roof, instead of being held in the heating apparatus.

With this valve, if desired, 10 to 20 pounds back pressure can be carried as well as one pound.

PRICES AND DIMENSIONS.

Sizes of Valves	Diameter of Flanges	Distance, face to face of Flanges	Prices
2 in.	6 in.	6½ in.	$20
2½ in.	7 in.	7 in.	$24
3 in.	8 in.	8½ in.	$30
4 in.	10 in.	10½ in.	$40
5 in.	11 in.	11½ in.	$55
6 in.	12 in.	13½ in.	$75
7 in.	13 in.	14½ in.	$100
8 in.	14 in.	15½ in.	$130
10 in.	16 in.	19½ in.	$200
12 in.	20 in.	24½ in.	$275

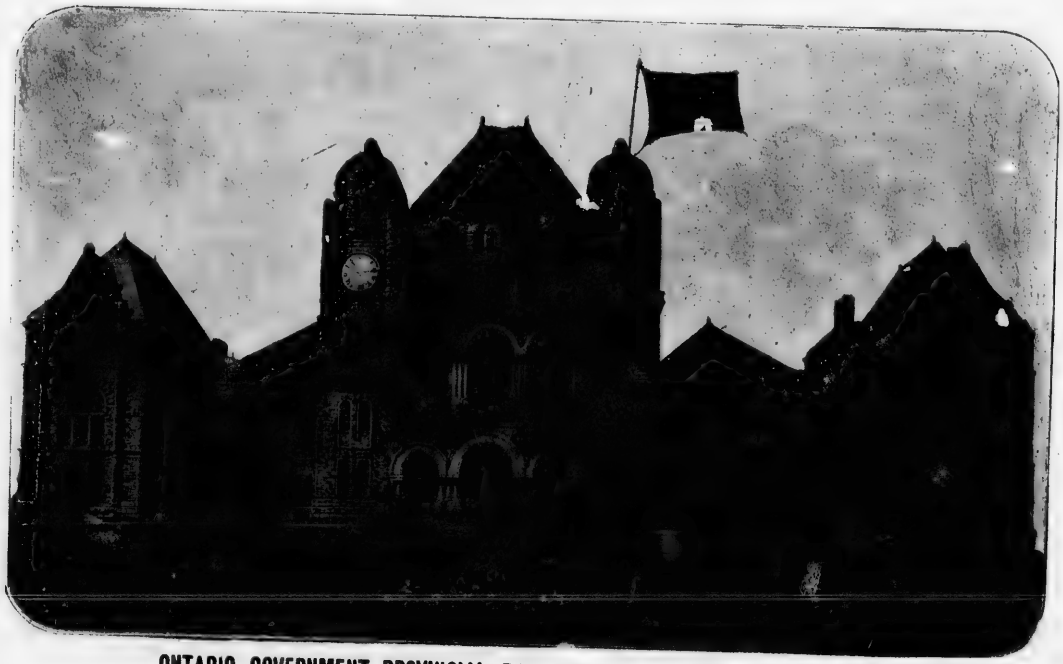
To the Trade and Architects

WE draw special attention to the accompanying illustrations (which have been made at a very great cost) of a few of the best buildings erected in the Dominion of Canada during the past few years, each of which has been fitted throughout with "Safford" Patent Radiators for either Steam or Hot Water.

Owing to lack of space in this edition, we cannot show but very few of the many photographs that we have received.

We trust our efforts to present a varied selection of Canada's best buildings will be appreciated by those who desire to know what is being done in architecture in the different provinces throughout the Dominion.

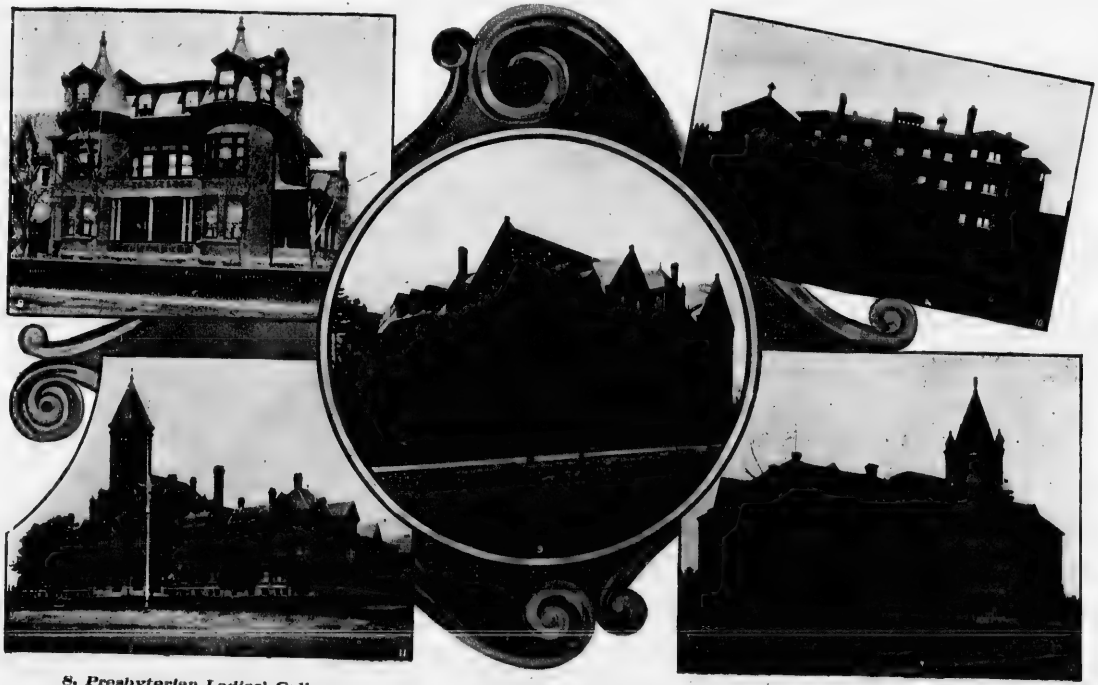
THE TORONTO RADIATOR MANFG. CO., LTD.



ONTARIO GOVERNMENT PROVINCIAL PARLIAMENT BUILDINGS, TORONTO, ONT.

2. *Biological Department (Toronto University)*
5. *Residence Mr. W. D. Matthews*
3. *Residence Mr. Geo. Gooderham*
6. *Toronto University and Museum*
4. *University Library Building*
7. *Residence Mr. F. Crompton*

TORONTO ONT.

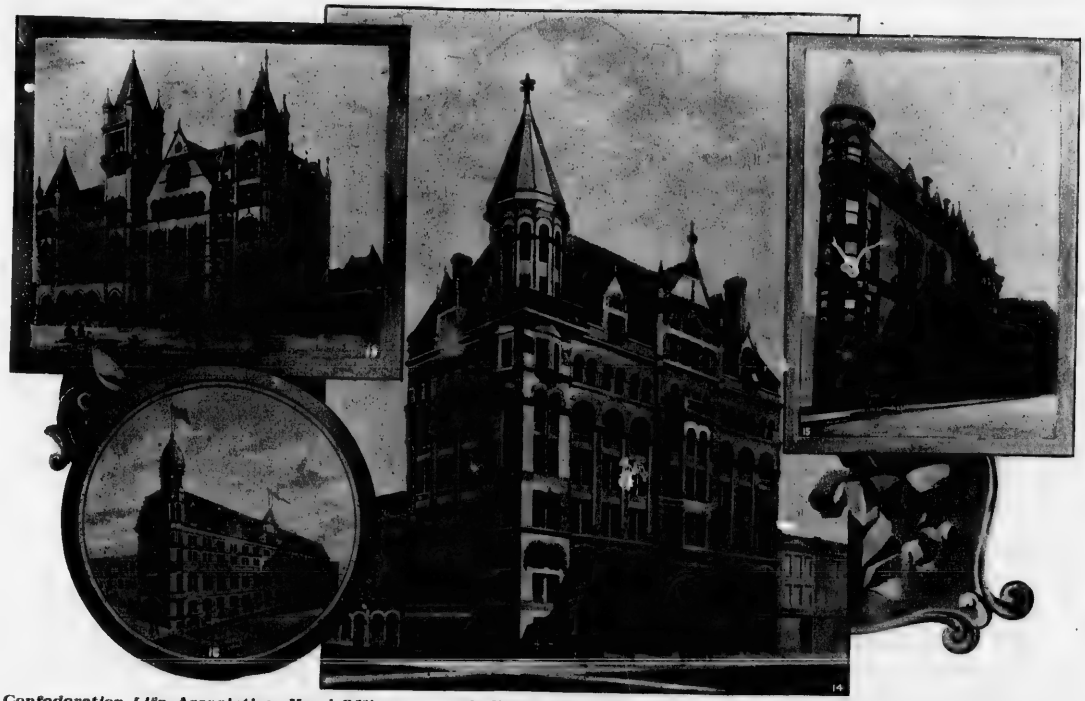


8. Presbyterian Ladies' College
11. New Upper Canada College

9. Wycliffe College

10. Bishop Strachan School
12. School of Practical Science

TORONTO, ONT.



13. Confederation Life Association, Head Offices
16. Globe Publishing Co.

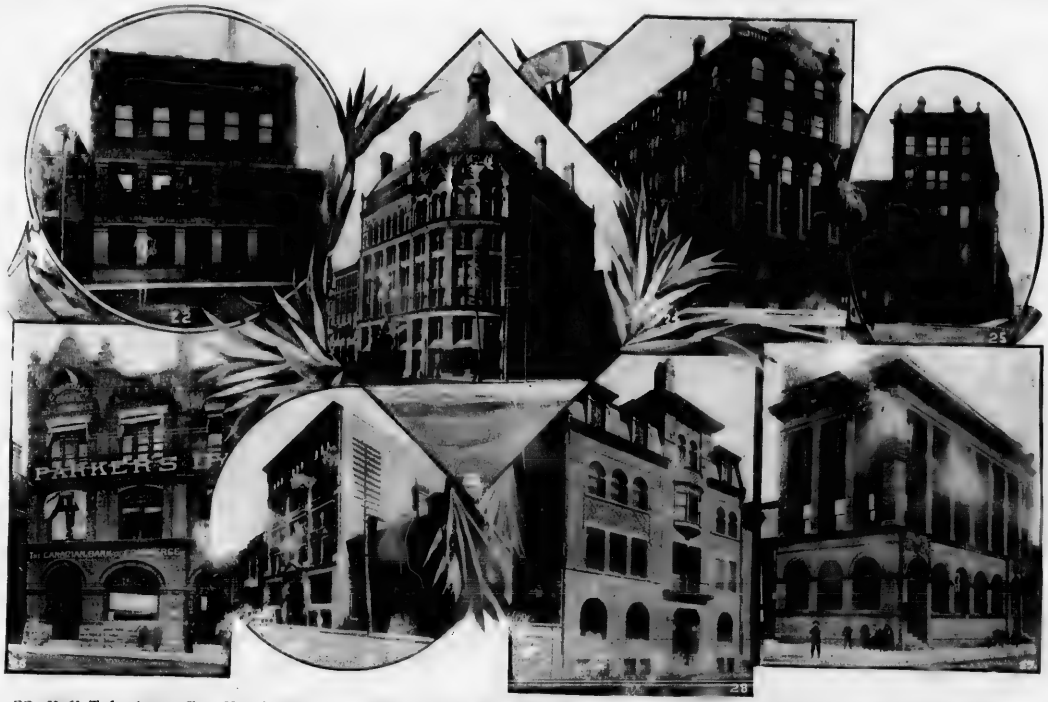
14. Freehold Loan and Savings Co.

15. Coffin Block
Offices of Gooderham & Worts

TORONTO, ONT.

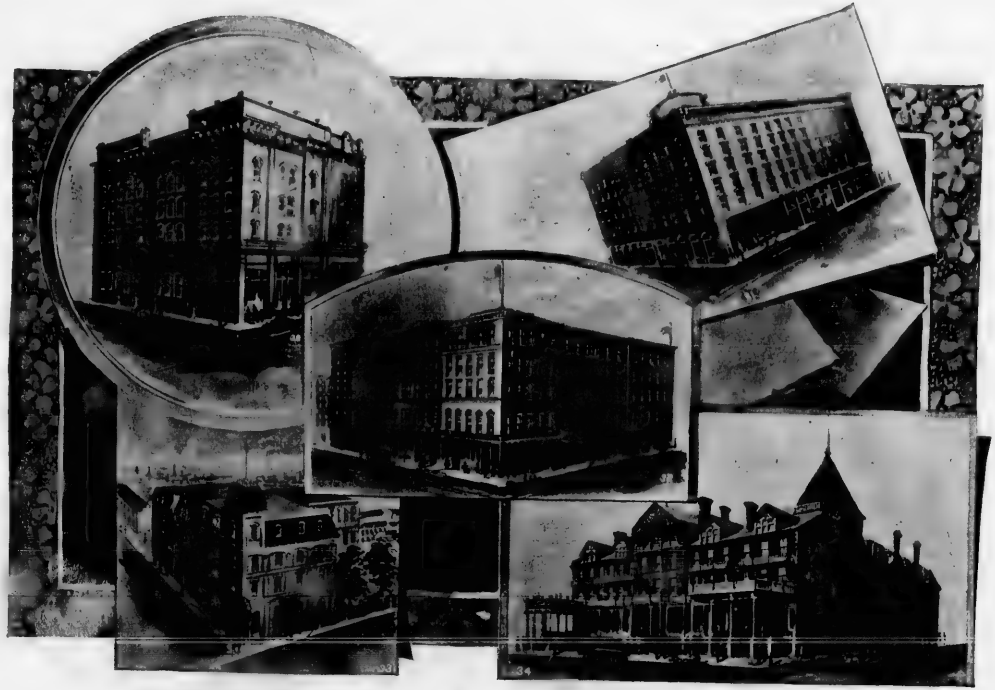
17. St. Alban's Cathedral 18. West Association Hall (Y. M. C. A.)
19. Central Methodist Church 20. Church of the Messiah 21. St. Mary's Convent

TORONTO, ONT.



22, Bell Telephone Co., Head Offices 23, Toronto Board of Trade 24, Toronto General Trusts Corporation
26, Branch Canadian Bank of Commerce 27, Toronto Times Publishing Co. 25, Traders' Bank of Canada
28, Athenæum Club, 20, Dominion Bank

TORONTO, ONT.

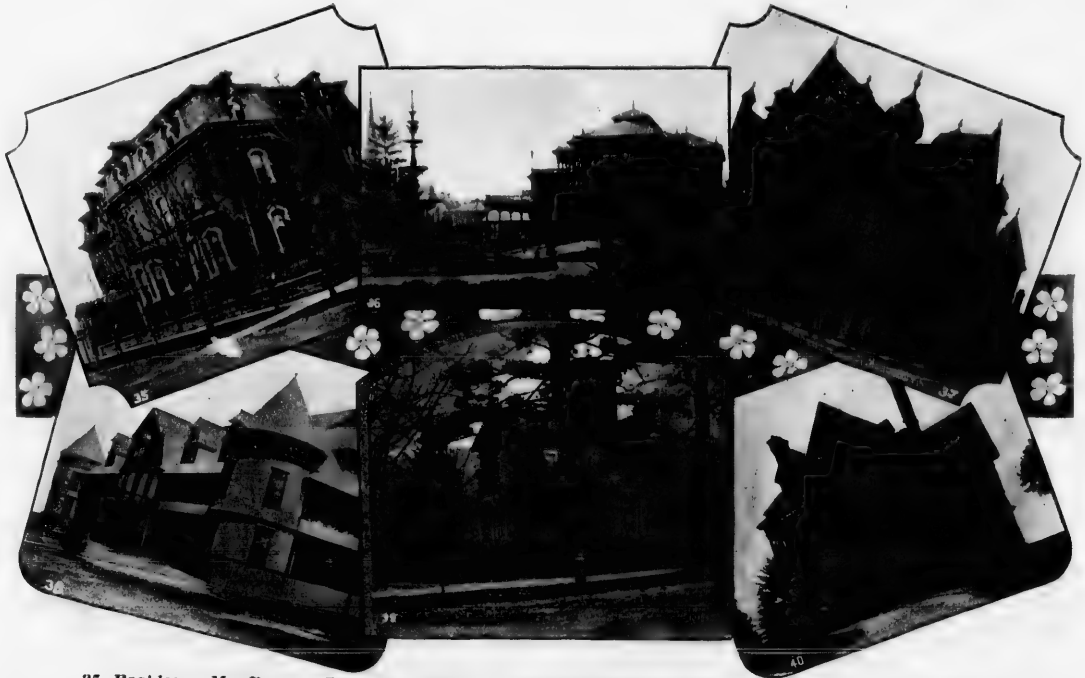


30. *Metropole Hotel*
33. *Elliott House*

32. *Rossin House*

31. *Kensington Hotel*
34. *Arlington Hotel*

TORONTO, ONT.



35, Residence Mr. Duncan Coulson — 36, Horticultural Gardens Pavilion — 37, Homoeopathic Hospital
38, Island Hospital for Sick Children — 39, Residence Mr. John Drynan — 40, Residence Mr. E. Henderson

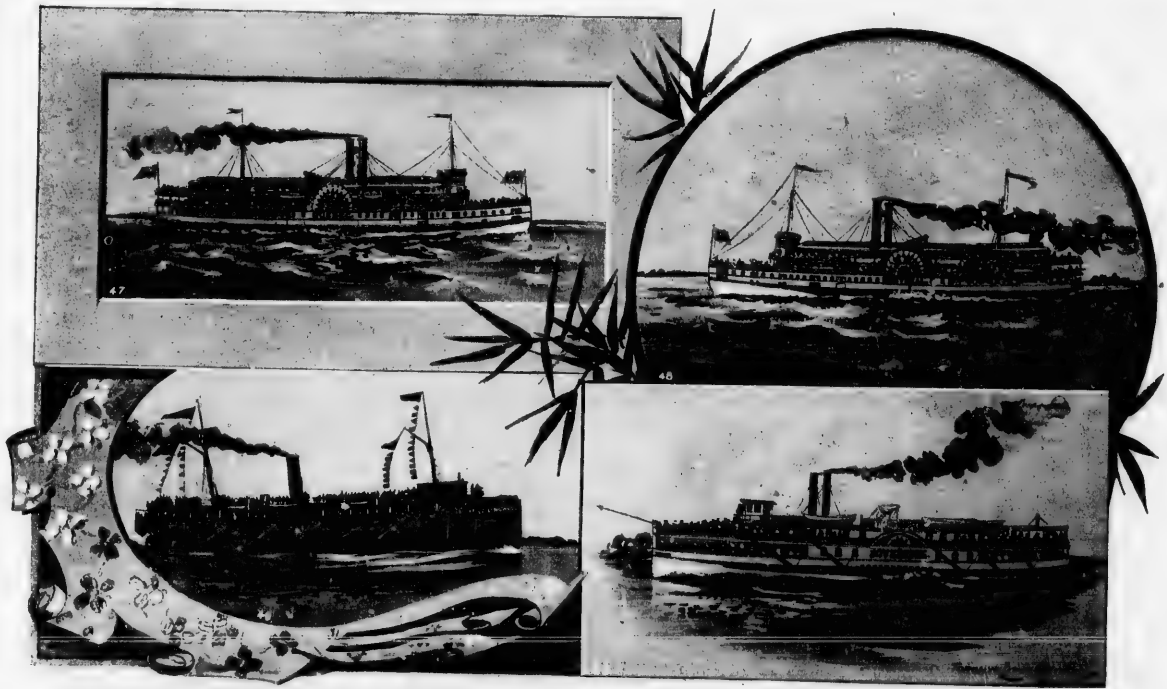
TORONTO, ONT.

41, Residence Dr. Sweetnam
44, Residence Mr. Gus. Thomas

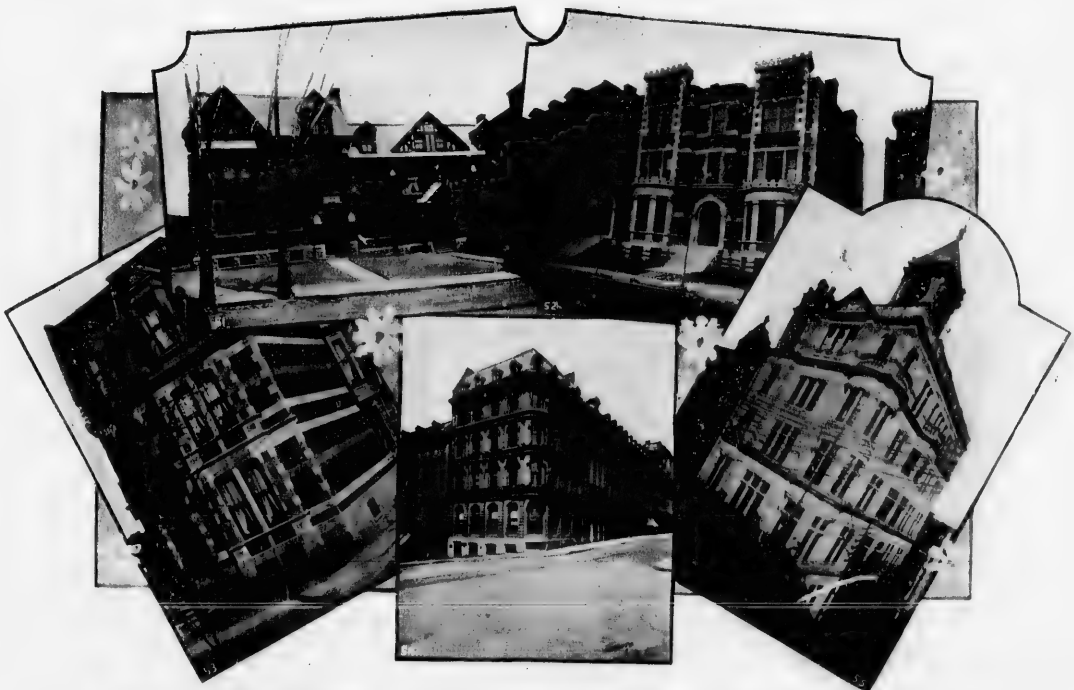
42, Residence Mr. Adam Armstrong
45, Residence Dr. G. S. Ryerson

43, Residence Mr. T. Eaton
46, Residence Capt. Krangle

TORONTO, ONT.



47. Steamship "City of Quebec," Montreal, Que.
48. Steamship "City of Montreal," Montreal, Que.
49. Steamship "City of Collingwood," Owen Sound, Ont.
50. Steamship "Sovereign," Ottawa, Ont.



51. Boys' Home
53. Self-Contained Residence
52. Residences Mr. H. J. Tellier and Mr. E. E. Rothwell
54. La Banque Nationale
55. Head Offices Sun Life Insurance Co.

MONTREAL, QUE.

56. Residence Mr. R. A. Mainwaring
57. Mr. Jas. Shearer's Block Self-Contained Residences
58. Wilson Frost's Block Self-Contained Residences
59. Wilson Frost's Block Self-Contained Residences
60. Monument National

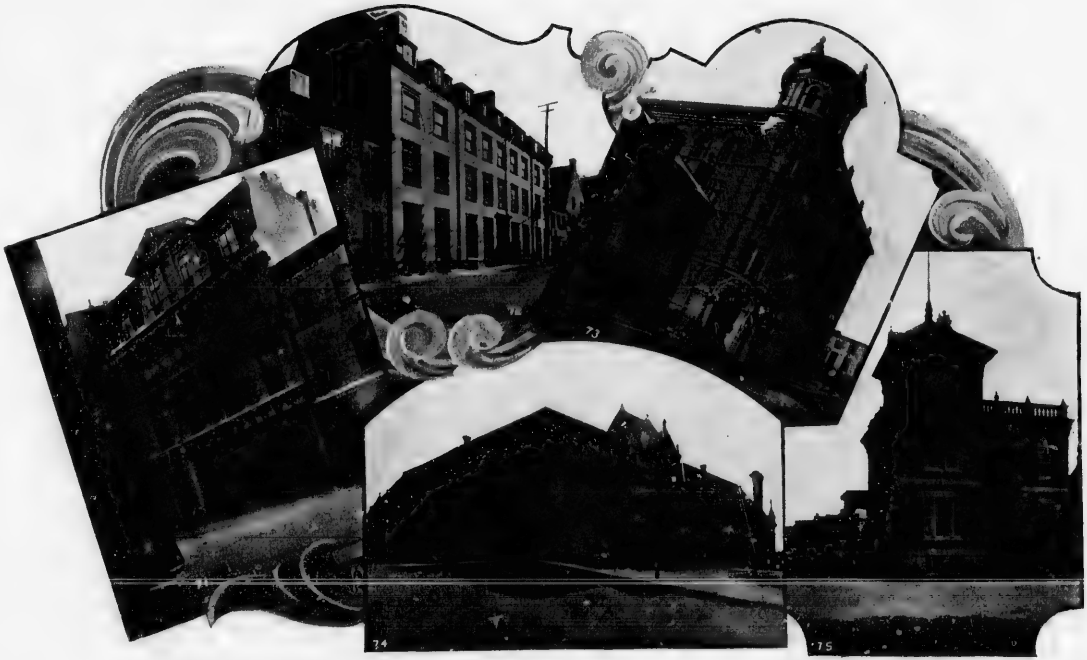
MONTREAL, QUE.

61. Shearer's Block
62. Carlsey's "Dry Goods" Block (Largest in Canada)
63. Self-Contained Residences
64. Residence Mr. O'Brien
65. College of Immaculate Conception

MONTREAL, QUE.

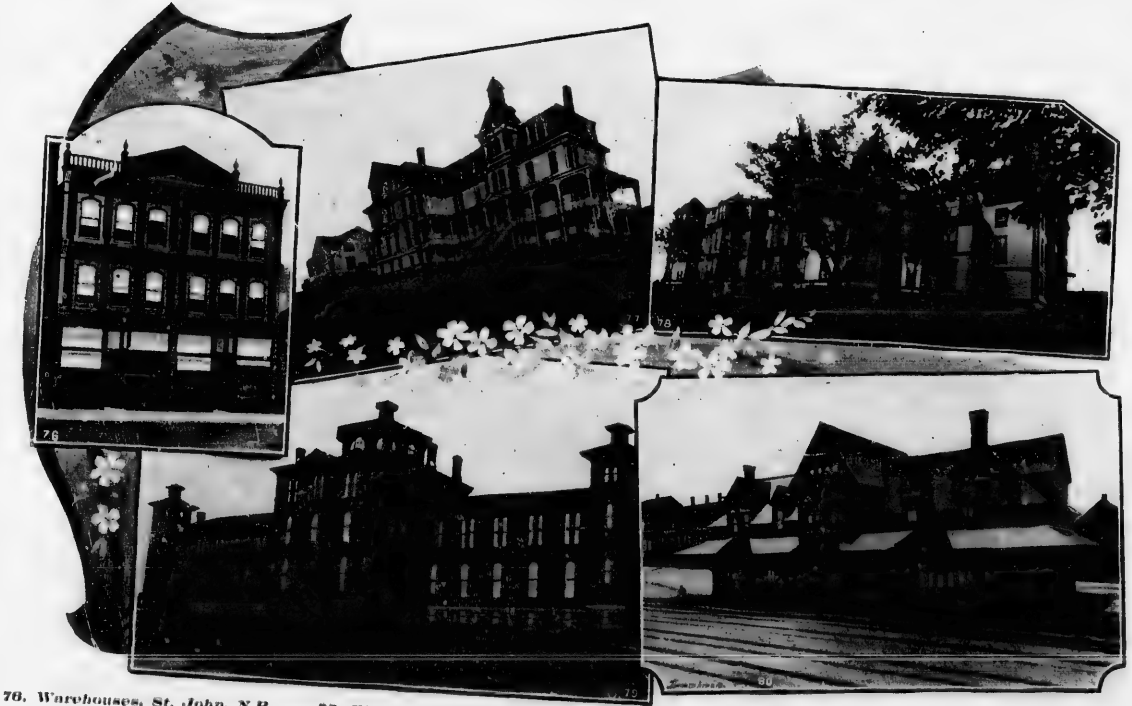
66. Library Building McGill University
67. Block of Wilson & Frost's Self-Contained Residences
68. Fire Hall and Police Station
69. Grace Church
70. Physics Building McGill University

MONTREAL, QUE.



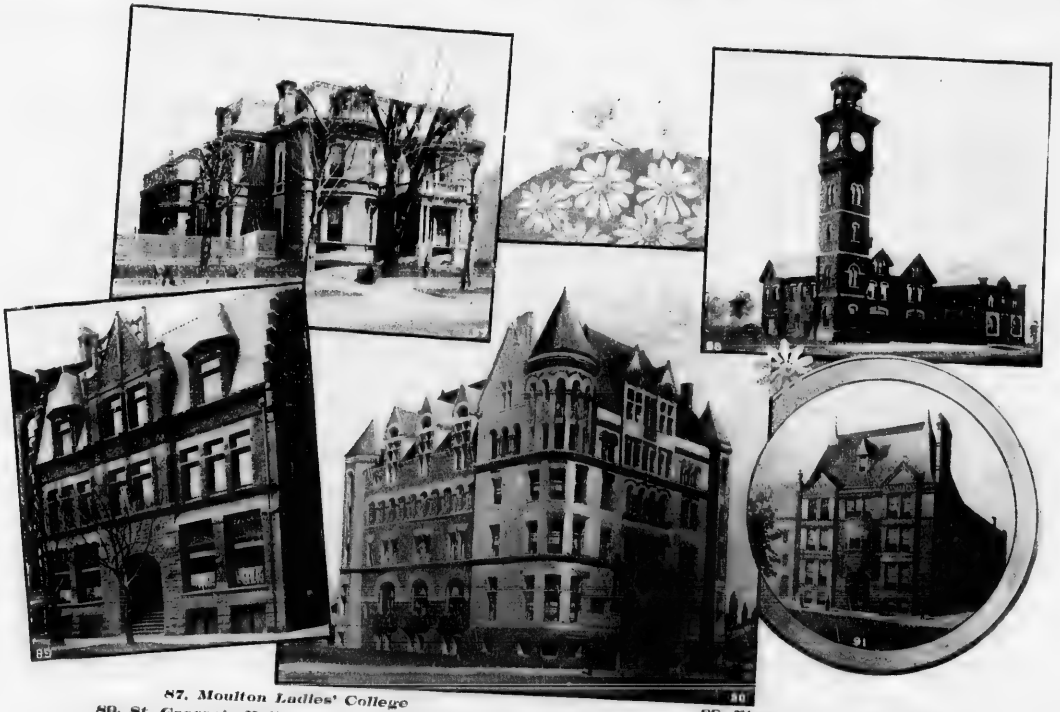
71. Stores of Cyr Duquet *72. Albion Hotel* *73. Wholesale Warehouses of P. Garneau & Fils*
74. Hotel Dieu Hospital *75. Residence Mr. Chas. Gagnor*

QUEBEC, QUE.



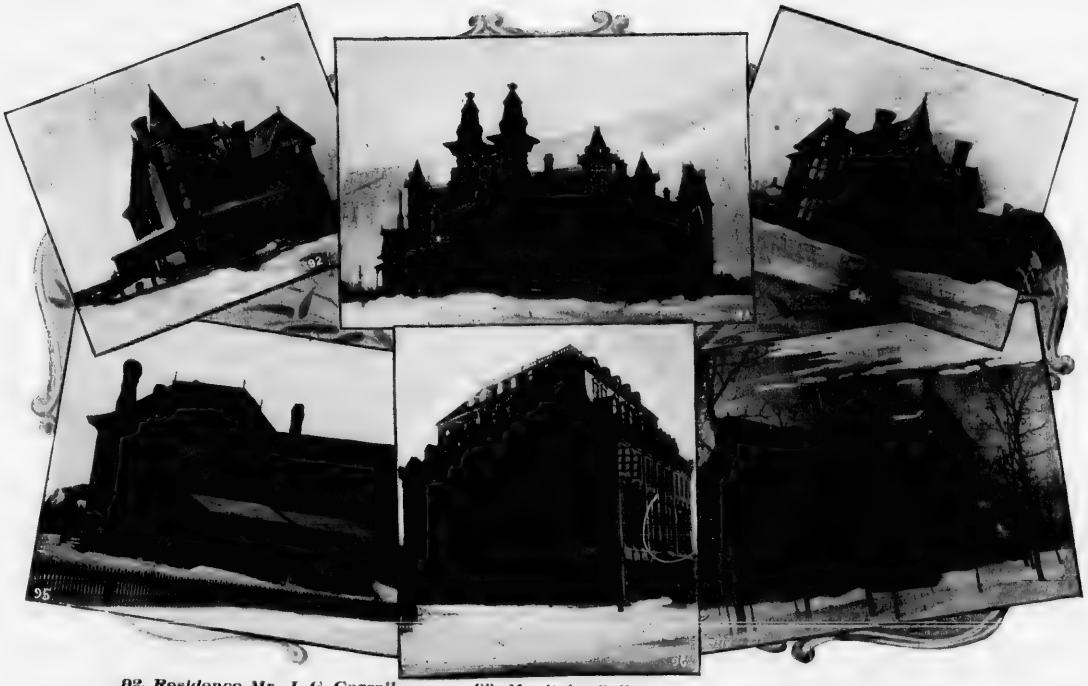
76. Warehouses, St. John, N.B. 77. Church School for Girls, Edgehill, Windsor, N.S. 78. Acadia College, Wolfville, N.S.
79. Public Hospital, St. John, N.B. 80. Passenger Depot, New Glasgow, N.S.

81. St. Joseph Church, Sydney, C.B. 82. Convent, Sydney, C.B. 83. Academy, Sydney, C.B.
85. Parliament Buildings, Fredericton, N.B. 84. Rev. Dr. Brossard's, Montreal, Que. 86. Union Club, St. John, N.B.



87. Moulton Ladies' College
89. St. George's Hall
90. Toronto Athletic Club
88. Fire Hall and Police Station
91. Young Women's Christian Guild

TORONTO, ONT.



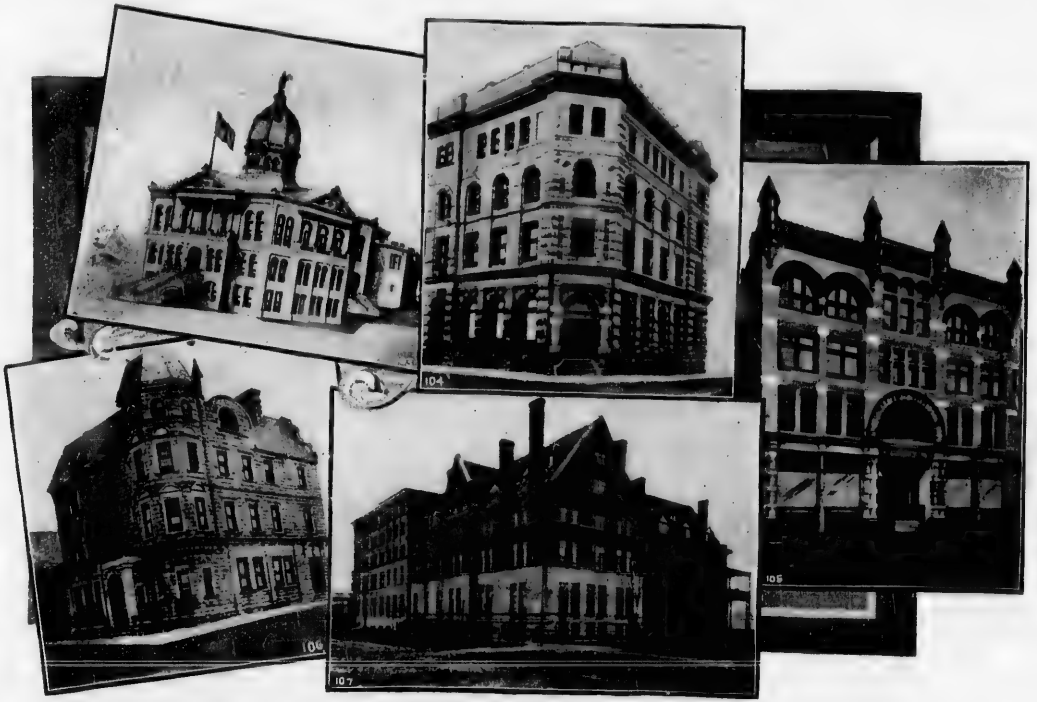
92. Residence Mr. J. G. Carroll
95. Residence Chief Justice Taylor

93. Manitoba College
96. Hotel Lelland

94. Residence Mr. ——
97. Residence Mr. John F. Galt

WINNIPEG, MAN.

98. Masonic Hall, New Westminster, B.C. 99. Bank of Montreal, Calgary, Alta. 100. Alexander Block, Calgary, Alta.
101. Hotel Victoria, Victoria, B.C. 102. Stobart, Sons & Co., Winnipeg, Man.



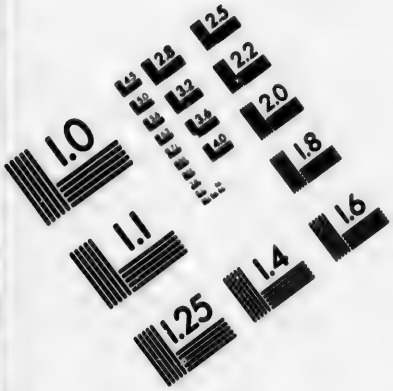
103. City Hall
106. Bank of Montreal

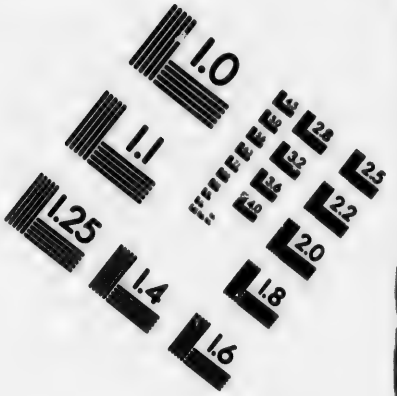
104. Bank of British North America
107. Vancouver Hotel

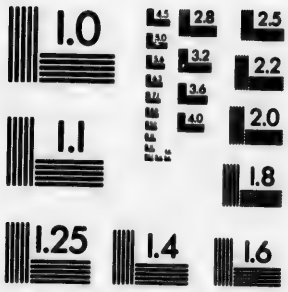
105. Hotel Metropole

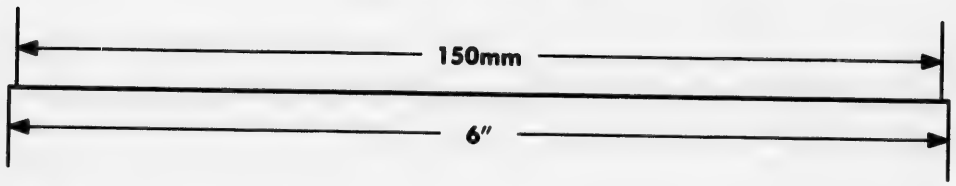
VANCOUVER, B.C.

IMAGE EVALUATION
TEST TARGET (MT-3)









APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989

108, Holland Block, Vancouver, B.C. 109, Five Sisters' Block, Victoria, B.C.
111, New England Hotel, Vancouver, B.C.
110, Bigbie & Burns' Block, New Westminster, B.C.
112, Board of Trade, Victoria, B.C. 113, Driard Hotel, Victoria, B.C. 114, Davie Block, Victoria, B.C.

115. Loretto Convent, Hamilton, Ont. 116. Residence Mr. George E. Tuckett, Hamilton, Ont.
118. Amasa Wood Hospital, St. Thomas, Ont. 117. General Hospital, Chatham, Ont.
119. Oxford County Court House, Woodstock, Ont. 120. Two Residences, Hamilton, Ont.

121. Residence Ames Pugsley, Amherst, N.S.
122. Residence Mr. D. McManney, Sherbrooke, Que.
123. L'Eglise de la Nativite, Hochelaga, Montreal, Que.
124. Collegiate Institute, Kingston, Ont.
125. Dry Goods Warehouse Mr. Thomas Watkins, Hamilton, Ont.
126. McGarvey & Sons' Furniture Warerooms, Montreal, Que.

127. Mr. Thomas Trow, Stratford, Ont. 128. Myers' Block, Stratford, Ont. 129. Residence Jr. S. C. Warnner, Napanee, Ont,
130. Residence Mr. Thomas G. Whiskard, Victoria Park, London, Ont. 131. Sisters of St, Joseph Hospital, London, Ont.

Safford Radiators

Safford Radiators are now used in heating the largest and finest buildings in Canada. We give a few references from the many thousand we have on file, as follows :

Colleges, Schools, Convents, and Churches.

Agricultural College	Guelph, Ont.
Queen's College (in part)	Kingston, Ont.
Hellmuth Ladies' College	London, Ont.
McGill University (Engineering Bldgs.)	Montreal, Que.
" " (Library Bldg.)	"
" " (Physics Bldg.)	"
College of Immaculate Conception	"
Ottawa College	Ottawa, Ont.
Bishop Ridley College	St. Catharines, Ont.
Alma Ladies' College	St. Thomas, Ont.
Toronto University	Toronto, Ont.
University Biological Dept.	"
University Museum	"
University Library	"
University Gymnasium	"
Wycliffe College	"
Upper Canada College	"
Veterinary College	"
School of Practical Science	"
Moulton Ladies' College	"
Presbyterian Ladies' College	"
The Commercial College	"
Conservatory of Music	"
Ladies' College	Toronto, Ont.
St. Michael's College	"
Acadia University	Windsor, N.S.
Manitoba College	Winnipeg, Man.
Baptist College	Woodstock, Ont.
Collegiate Institute	Galt, Ont.
Collegiate Institute	Kingston, Ont.
Trafalgar Institute	Montreal, Que.
School of Art	"
Public School	Niagara Falls, Ont.
Norwood Public School	Norwood, Ont.
Bishop Bethune School	Oshawa, Ont.
Normal School	Ottawa, Ont.
Public School	Pt. Aux Trembles, Que.
Commercial School	Quebec, Que.
School of Arts	"
Public School	St. Catharines, Ont.
Academy	N. Sydney, C.B.
Convent School	St. Boniface, Man.
Collegiate Institute	Toronto, Ont.
Normal School	"
Bishop Strachan School	"
School of Arts	"

Colleges, Schools, Convents, and Churches—*Continued.*

Dorset School	Toronto, Ont.
St. Andrew's Church Institute	"
St. Mary's School	"
Loretto Convent School	"
Society of Arts	"
College of Commerce	"
Church School for Girls	Windsor, N.S.
Loretto Convent	Hamilton, Ont.
Hotel Dieu (Convent)	Levis, Que.
St. Joseph's Convent	N. Sydney, N.S.
Hotel Dieu (Convent)	Quebec, Que.
Notre Dame de St. Roche (Convent)	"
Convent of Trois Pistoles	Trois Pistoles, Que.
St. Mary's Convent	Toronto, Ont.
St. Basil's Novitiate	"
Sunnyside Orphanage	"
Loretto Abbey	"
Dr. Barnardo's Home	"
Boys' Home	"
R. C. Cathedral	Belleville, Ont.
R. C. Cathedral	Gananoque, Ont.
Church Notre Dame de Grace	Hull, Que.
Christ Church Cathedral	Hamilton, Ont.
St. Mary's Cathedral	Kingston, Ont.
St. Peter's Cathedral (in part)	Montreal, Que.
German Lutheran Church	"
St. Anne's Church	"
St. Charles' Church	"
R. C. Church, Mile End	"
Grace Church	"
Notre Dame Church	"
St. Joseph's Church	N. Sydney, C.B.
Presbytere de St. Jean	Port Solis, Que.
Ecole Chetienne des Presbytaire	St. Roche, Que.
Church (Cure, J. Giroux)	St. Ambroise, Que.
St. James' Cathedral	Toronto, Ont.
Church of Messiah	"
Baptist Church (Walmer Road)	"
Central Presbyterian Church	"
St. Alban's Cathedral	"
Central Methodist Church	"
R. C. Church	Joliette, Que.
R. C. Church	Yamacliche, Que,
R. C. Church	Cape St. Ignace, Que.
Hochelaga R. C. Church	Montreal, Que.
Little Sisters of the Poor	"
New High School	"
Bishops' College	Lennoxville, Que.

Government, Municipal, Hospital, and other Buildings.

Parliament Buildings	Fredericton, N.B.
Custom House	Kingston, Ont.
Post Office	Port Arthur, Ont.
Custom House	Peterborough, Ont.
New Parliament Buildings	Toronto, Ont.
Government House	"
Board of Trade	Victoria, B.C.
Provincial Jail	"
Post Office and Customs	Walkerton, Ont.
Court House	Barrie, Ont.
C.P.R. Passenger Depot	Chatham, Ont.
Police Court and Central Station	"
County Buildings	Guelph, Ont.
C.P.R. Passenger Depot	Ingersoll, Ont.
C.P.R. Passenger Depot	London, Ont.
C.P.R. Offices	"
New Station	New Glasgow, N.S.
County Court House	Pictou, N.S.
Court House	Quebec, Que.
Smith's Falls Station	Smith's Falls, Ont.
C.P.R. Passenger Depot	Sherbrooke, Que.
County Registry Offices	St. John, N.B.
Fire Hall and Police Station	Toronto, Ont.
C.P.R. Passenger Depot	"
County Registry Office	Toronto, Ont.
New Court House	Woodstock, Ont.
Widows' Home	Brantford, Ont.
Home of Friendless	Chatham, Ont.
General Public Hospital	"
Public Hospital	Galt, Ont.
Insane Asylum	Hamilton, Ont.
House of Providence	Kingston, Ont.
Hotel Dieu (Hospital)	"
London Hospital	London, Ont.
General and Marine Hospital	Owen Sound, Ont.
Hotel Dieu (Hospital)	Quebec, Que.
Amasa Wood Hospital	St. Thomas, Ont.
Public Hospital	St. John, N.B.
Toronto General Hospital	Toronto, Ont.
Homœopathic Hospital	"
Sick Children's Hospital	"
Deer Park Sanitorium	"
Home for Incurables	"
Protestant Orphans' Home	"
Aged Women's Home	"
House of Refuge	Woodstock, Ont.
Fish and Game Club	Louisville, Que.
Toronto Asylum (Main Buildings)	Mimico, Ont.

Government, Municipal, Hospital, and other Buildings —*Continued.*

Boys' Home	Montreal, Que.
Hall and Club Room	New Glasgow, N.S.
Union Club Building	St. John, N.B.
Toronto Asylum (Old Buildings)	Toronto, Ont.
The Ontario Reform Club	"
The Toronto Club	"
The Toronto Athletic Club	"
The Athenæum Club	"
Academy of Music	"
Y.M.C.A. (New Building)	"
Y.W.C. Guild (New Building)	Toronto, Ont.
Y.W.C. Guild (Old Building)	"
The Auditorium	"
St. George's Hall	"
Victoria Skating Rink	"
Kilbourn Opera House	Toronto Junction, Ont.
Conservatory of Music	Victoria, B.C.
Fire Hall and Police Station (Rachel St.)	Montreal, Que.
The Laurentian Swimming Baths	"
The Reformatory (Mignonne St.)	"

Bank and Office Buildings and Stores.

Bank of Toronto	Barrie, Ont.
Bank of Commerce	"
Merchants Bank	Chatham, Ont.
Standard Bank	"
Merchants Bank of Halifax	Fredericton, N.B.
Bank of Montreal	Guelph, Ont.
Bank of Montreal	Hamilton, Ont.
Bank of Hamilton	"
Traders Bank	"
Molsons Bank	"
Dominion Bank	Lindsay, Ont.
La Banque Nationale	Montreal, Que.
La Banque du Peuple	"
Bank of Commerce	Montreal, Que.
Merchants Bank of Halifax	"
Bank of Montreal	Ottawa, Ont.
Bank Note Building	"
Bank of Montreal	Quebec, Que.
Banque Nationale	Sherbrooke, Que.
Banque Nationale	St. Roche, Que.
Banque Nationale	St. Sauveur, Que.
Banque Jacques Cartier	"
Dominion Bank (North)	Toronto, Ont.
Dominion Bank (East)	"
Imperial Bank	"
Imperial Bank (Branch)	"

Bank and Office Buildings and Stores – *Continued.*

Bank of Commerce	Toronto, Ont.
Traders Bank	"
Bank of British North America	Vancouver, B.C.
Bank of Montreal	"
Bank of British North America	Victoria, B.C.
Imperial Bank	Winnipeg, Man.
Commercial Bank of Windsor	Windsor, N.S.
New Bank Block	Walkerville, Ont.
Bell Telephone Exchange	Montreal, Que.
Sun Life Assurance Co.	"
McKay Bros., Warehouse and Offices,	"
Seybold, Son & Co., " "	"
James Hutton & Co., " "	"
Traders Bank Chambers	Toronto, Ont.
Board of Trade (New Building)	"
The Globe Co. (New Building)	"
Toronto Lith. Co. (New Building)	"
Travellers' Ins. Co., Offices	"
Citizens' Ins. Co., Offices	"
Manufacturers Ins. Co., Offices	"
Canada Life Ins. Co. (Old Building)	"
Canada Permanent Bldg. (50 Offices)	"
London & Canadian Chambers	"
Toronto Chambers (100 Offices)	"
Arlington Chambers (20 Offices)	"
Kerr's Arcade (Yonge St. Market)	Toronto, Ont.
McBean's Block (Stores and Offices)	"
Richmond Chambers	"
Snowdon Block	"
Thompson's Block	"
Commercial Travellers' Building	"
Toronto General Trust Co., Offices	"
Freehold Loan and Savings (New Bldg)	"
Confederation Life Building	"
Consumers Gas Co., Works and Offices,	"
Fisken's Buildings	"
George A. Cox (Office Building)	"
Toronto Land and Investment Co., Block of Offices	"
Toronto Real Estate and Investment Co., Block of Offices and Stores	"
Bickford's Block	"
Alex. Manning (50 Stores, Offices)	"
Mallon's Block	"
John Wanless & Sons, Stores and Offices,	"
Dr. Bryce's Block (Stores and Offices),	"
A. C. Thompson's Buildings, upwards of 350 Offices	"
A. G. Strathy's Building, upwards of 200 Offices	"

Bank and Office Buildings and Stores – *Continued.*

J. L. Thompson's Warehouses, upwards of 500 Offices	Toronto, Ont.
Major Foster's Warehouses	"
T. Milburn's Warehouses	"
P. W. Ellis' Warehouses	"
S. H. Janes, Offices	"
Pearson Bros., Offices	"
Roaf Estate, Stores and Offices	"
Bank of Commerce, East End Branch	"
Masonic Hall (East)	"
A. C. Thompson's Block	Toronto Junction, Ont.
Cowen's Wholesale Block	Toronto, Ont.
Dingman's Wholesale Block	"
Deahl's Warehouse and Offices	"
Victoria Chambers (40 Offices)	"
Truth Publishing Co.	"
Times Publishing Co.	"
Hardware Publishing Co.	Toronto, Ont.
Monetary Times Publishing Co.	"
Empire Publishing Co.	"
Globe Publishing Co.	"
Land Security Co., Block of Offices	"
Major Carlaw's Wholesale Block	"
Douglass (Wholesale Warehouses)	"
Gooderham & Worts, "Coffin Block,"	"
Joseph Estate (Block, Stores, Offices)	"
Christie, Brown & Co. (Biscuit Factory)	"
Equity Chambers, Offices	"
Home Loan & Savings Co., Offices	"
Coffee House Ass'n (Restaurant, Offices)	"
North British & Mercantile Ins. Co.	Montreal, Que.
La Banque d'Hochelaga (St. Lawrence Branch)	"
Le Monument Nationale	"

Hotels.

Albion Hotel	Belleville, Ont.
Mississippi Hotel	Carleton Place, Ont.
Plunkett's Hotel	Cobourg, Ont.
Parker's Hotel	Drumbo, Ont.
Imperial Hotel	Galt, Ont.
Windsor Hotel (in part)	Montreal, Que.
Queen's Hotel	Oshawa, Ont.
Patterson House	Owen Sound, Ont.
Hotel Del Monte	Preston, Ont.
Albion Hotel	Quebec, Que.
F. Bouret's Hotel	"
Long's Hotel	Ridgetown, Ont.

Safford Radiators

Hotels — *Continued.*

Fisher's Hotel	St. John, N.B.
C. Hand's Hotel	Sarnia, Ont.
Palmer & Moore Hotel	Stratford, Ont.
Arlington Hotel	Toronto, Ont.
Palmer House	"
Kensington Hotel	"
Albion Hotel	"
Palace Hotel	"
Dominion Hotel	"
Strathy's Hotel	"
Pioneer Hotel	"
Booth's Hotel	"
Knowles' Hotel	"
Robinson House	"
Neelon House	"
Russell House	"
Evans' Hotel	"
Rossin House (in part)	"
Metropole Hotel	"
Elliott House	"
Ayer's Hotel	Toronto, Ont.
Caer-Howell Hotel	"
Mallon's Hotel	"
White's Hotel	"
Gladstone Hotel	"
Clarke's Hotel	"
The Headquarters	"
Black Bull Hotel	"
Stoneham's Hotel	"
Haydon's Hotel	Toronto Junction, Ont.
Driard Hotel	Victoria, B.C.
Hotel Metropole	Vancouver, B.C.
Hotel Victoria	"
New England Hotel	"
Vancouver Hotel	"
Hotel Thomas	Windsor, N.S.
Walker's Hotel	Walkerville, Ont.
New York House Hotel	Montreal, Que.
The Brennan House	"
Roberval Hotel	Lake St. John, Que.

Steam Vessels.

Steamer "City of Collingwood"	Owen Sound, Ont.
Steamer "City of Montreal"	Montreal, Que.
Steamer "City of Quebec"	"
Steamer "Sovereign"	Ottawa, Ont.
Steamer "James Swift"	Kingston, Ont.
Steamer "Yosemite"	Victoria, B.C.
Dredge "Alex. Manning"	Port Colborne, Ont.

Residences and Stores

H. Hollgate, residence, Allandale, Ont.
John Watson, residence, Ayr, Ont.
Judge Plamondan, residence, Arthabaskaville, Que.
Madame V. Tessier, residence, Arthabasca, Que.
E. O. Rielley, store and residence, Aylmer, Que.
Mrs. A. Robb, residence, Amherst, N.S.
C. A. Lowe " "
Amos Purdy " "
Dr. Allan " "
H. Lennox " Barrie, Ont.
W. W. Thomson " "
J. P. Cooper " Brampton, Ont.
Fred Chalcroft " Brantford, Ont.
G. E. Frankland " "
T. Hollindrake " "
T. Walsh " "
H. Shapeley " "
Peter Wood " "
J. S. Hamilton " "
James Livingstone, M.P., residence, Baden, Ont.
J. McDougall, residence, Berlin, Ont.
John Doyle " Belleville, Ont.
F. G. Lockett " "
J. Caldwell " "
L. B. Terwilliger " "
Dr. Coleman " "
A. McGinnis " "
James Vair " Barrie, Ont.
James Wilkinson " "
J. N. Kirchoffer " Brandon, Man.
Capt. B. Markler " Brule, Colchester Co.
Mr. St. Martin " Chatham, Ont.
T. H. Smith " "
George Stephens " "
John Driggott " "
American Consul " "
James Holmes " "
Angus McIntosh " "
M. Houston " "

Casselman Lumber Co., residence, Casselman, Ont.
Ferris & Co., warehouse, Campbellford, Ont.
Dr. E. Mallory, residence, Colborne, Ont.
P. J. Lightbourne " Colbourg, Ont.
Mrs. Crossen " "
W. H. Shoenberger " "
John Smart " Collingwood, Ont.
Mrs. Berry " "
E. R. Carpenter " "
Enterprise Office, office "
C. B. Dunham, residence, Canso, N.S.
Senator J. A. Lougheed, residence, Calgary, N.W.T.
William Pierce " "
Peter McCarty " "
Hudson Bay Co.'s Stores, stores "
E. J. Maxwell, 2 stores, Cote St. Aubonier, Que.
J. L. Goodhue, stores, Danville, Que.
Dr. Savage, residence, Elora, Ont.
R. Chestnut & Sons, residence, Fredericton, N.B.
J. Buchanan " Galt, Ont.
R. Scott " "
R. McDougall " "
A. J. Oliver " "
Thomas Smith " "
J. Sharpe " "
Ed. Koepell, barber shop "
Thomas McDougall, residence "
John Brown " "
J. N. McKendrick " "
J. Caves " "
Alexander Gartshore, residence, Hamilton, Ont.
W. S. Duffield " "
John Weatherstone " "
Martin Malone " "
Joseph Lister " "
Wm. Stewart " "
James Balfour (architect) " "
John Stewart " "
F. E. Leather " "

H. B. Whitton, residence, Hamilton, Ont.
Ald. James Dixon " "
Samuel Barker " "
Thomas C. Watkins, store "
Rev. S. Lyle, residence "
J. M. Loltridge " "
Robert M. Johnston, residence, Halifax, N.S.
Charles E. Puttner " "
James Reeves " "
John C. Mahon 2 " "
Frank Roberts " "
W. A. Freeman " "
W. L. Barnstead " "
Collins Estate "
William Dennis " "
William T Horton " "
John Borton " "
John McCrow " "
John W. Gorham " "
J. E. Roy 6 " "
William Dunbar " "
Thomas Mowbray " "
C. W. Anderson " "
John W. Burton " "
W. H. Pallister " "
John Calder " "
J. A. Nadeau " Iberville, Que.
Dr. D. C. Hickey " Kingston, Que.
Dr. Herald " "
Dr. Clements 2 " "
John Mudie 2 " "
J. B. Carruthers, offices "
Patrick Brown, residence "
Thomas Brooks " "
Robert McFail " "
Mr. Maund " "
J. C. Mitchell " "
Judge Price " "
John McLeod, 2 " Kingston, Ont.

Safford Radiators

References—*Continued.*

John O'Shea, residence, Kingston, Ont.
Francis McNab " "
Robert Sears " "
Prof. Goodwin (Queen's College), residence, Kingston
Mr. Campbell, residence, Kingston, Ont.
C. H. Reid " "
John Swan " Kincardine, Ont.
Christie & Agar " "
R. Sylvester " Lindsay, Ont.
A. G. McPean " Lancaster, Ont.
A. McLennan " "
A. W. Woodward " London, Ont.
A. O. Graydon (architect), residence, London, Ont.
W. H. Heard, residence "
J. R. Shuttleworth " "
Globe Casket Co. " "
Dawes & Co., offices, Lachine, Que.
George Hott, " Longue Pointe, Que.
Mrs. Auty " Mitchell, Ont.
Charles Knees " Milton, Ont.
John Cudmore " "
E. Stock " Mimico, Ont.
Mr. Adamson " "
Hon. G. A. Drummond, offices, Montreal, Que.
Judge Doherty " "
Dr. A. W. Gardner " "
Dr. Hingstone " "
E. P. Hannaford (Chief Eng. G.T.R.), offices, Montreal
Dr. Delome, offices, Montreal, Que.
J. J. Curran, Q.C., offices, "
Henry Kavanagh, J.P. " "
A. C. Hutchinson (architect), offices, Montreal, Que.
Rev. Joseph Barclay " "
F. Gold Lyman 3 " "
H. Montague Allan " "
W. R. Elmenhorst " "
A. Baumgarten " "
Henry Dobell " "
W. D. McLaren " "

C. A. Briggs, offices, Montreal, Que.
Henry Millen " "
E. J. Barbeau " "
F. E. Phelan " "
James O'Brien " "
Charles Brodeur " "
Mrs. Simpson " "
R. K. Thomas " "
Thomas Lamb " "
Walter Kavanagh " "
W. Fraser " "
H. McLaren " "
John Gow " "
H. Lacroix " "
Mrs. E. Mackerrow " "
T. Chambers " "
S. A. DeLarimier " "
G. F. Phelps " "
James Smith " "
Wilson & Frost, 200 houses "
John Anderson, 9 " "
H. H. Knight, 6 " "
J. Ford, 4 " "
David McFarlane, 4 " "
L. Patton & Son, 3 " "
McGill University, 2 " "
Joseph Robert 3 stores "
James S. Snasdall, residence "
R. Cooper " "
Wesleyan Parsonage " "
Mrs. Whalen " "
Thomas Kinsella " "
James Rafter " "
Thomas Bain " "
John O'Leary " "
Thomas Phelan " "
J. T. Lyons " "
David Watson " "
J. H. Badger " "

T. H. Boyd, residence, Montreal, Que.
R. B. Swain " "
Alph David " "
W. Ewing " "
H. McLennan " "
R. C. Jamieson " "
W. D. McLaren, office "
Machinery Supply Association, office "
Baylis Manufacturing Co., works and office "
John Burns, shop "
Walker's Candy Store, shop "
W. Clendinning, jr., residence "
D. Bentley " "
John P. Seybold " "
R. D. McGibbon " "
L. R. Montebriand(architect) " "
Chris. Clift " "
Walter Drake " "
James Corristine " "
W. G. Evans " "
W. A. Scott " "
Ed. Archibald " "
S. Carsley " "
Walter Paul " "
Albert E. Smith " "
John Murphy " "
Thomas Mussen " "
Dr. Goucher " "
T. B. McAuley " "
Dr. Brossard " "
Dr. Vosburg " "
H. J. Tellier " "
E. E. Rothwell " "
R. A. Mainwaring " "
J. J. McGill " "
Hector Prevost " "
David Lewis " "
John McDougall " "
Robert Cowans " "

References—*Continued.*

Nap. Turcott,	residence,	Montreal, Que.	
Henry T. Bovey, LL.D.	"	"	
H. Joseph	"	"	
Thomas Lamb	"	"	
J. C. Wilson	"	"	
F. Fairman	"	"	
Sir Joseph Hickson	10	"	"
James Douglas	6	"	"
David Hog	6	"	"
Beckham & Scott	14	"	"
Peel & Simpson	6	"	"
W. G. Cruickshank	10	"	"
Fred Lyman	6	"	"
MacIntosh & Hyde	6	"	"
James Shearer	4	"	"
James S. Thompson	6	"	and offices "
Hirch's Tobacco Store, store			"
J. & H. Taylor, office			"
C.P.R. Ticket Office, office			"
Ewing, Herron & Co.	"		"
Mark Workman, store			"
Thomas Robertson & Co., showroom			"
Wright's Dry Goods Store, store			"
Dezouche's Fine Art Store	"		"
E. H. Copeland, store and residence			"
Auer Incandescent Light Co., office			"
James Baxter, office and residence			"
Sohmer Block, stores			"
Tooke Bros., Shirt Factory, factory			"
George Graham, store and resid nce			"
P. P. Dodds & Co., warehouse			"
A. Ramsay & Sons, office			"
A. M. Featherstone, store			"
B. J. Coghlin, office			"
John Duncan & Co., office and warehouse			"
Pilkington Bros.	"	"	"
Royal Electric Co., offices			"
H. & N. E. Hamilton, warehouse			"
Montreal Street Railway, offices			"

Rev. P. J. Harold,	residence,	Niagara, Ont.
Mrs. Russell	"	"
William Hewson	"	Niagara Falls, Ont.
John Bartle	"	"
John Worthington	"	"
John Robinson	"	"
H. L. Flaherty	"	"
Thomas Munford	"	"
James Smeaton	"	"
Z. B. Lewis	"	"
H. McGlashan	"	"
J. R. Peckham	"	"
James Lowell	"	"
M. H. Buckley	"	"
S. Marmby	"	"
J. A. Young	"	"
A. G. Hill	"	"
M. Doran	"	"
R. Coulson	"	"
Jacob Reitz	"	New Hamburg, Ont.
Harvey Graham	"	New Glasgow, N.S.
Capt. McIntosh	"	"
H. F. Cahoon	"	"
Thomas Fraser	"	"
Mrs. McKenzie	"	"
Robert Graham	"	"
Daniel Poulson	"	"
Baptist Parsonage	"	"
C. F. Major	"	New Westminster, B.C.
J. Hendry	"	"
I. B. Fisher	"	"
Masonic Block		"
Biglie Block		"
Burr Block		"
D. W. Gordon (M.P.)	"	Nanaimo, B.C.
Dr. McLaren	"	Ottawa, Ont.
Ald. W. J. Campbell	"	"
Ald. W. R. Stroud	"	"
James Mather	"	"

P. A. Eagleson,	residence,	Ottawa, Ont.
J. R. Arnoldi	"	"
John Martin	"	"
F. P. Bronson	"	"
A. French	"	"
J. M. Garland	"	"
J. C. Jamieson	"	"
R. H. Crane	"	"
G. F. Stonehouse	"	"
W. A. Waters, drug store		"
James Taylor, 2 houses		"
J. A. Corry, 3	"	"
R. S. Williams, residence		Oshawa, Ont.
G. Marlett	"	Oakville, Ont.
A. S. Patterson	"	"
Alfred Frost	"	Owen Sound, Ont.
W. H. Lowden	"	"
McCallum's Block, stores		"
Robert Reid, residence		"
W. J. Paterson	"	"
John Armstrong	"	"
Judge Lane	"	"
H. E. Smith	"	"
William Brown	"	"
B. Travers	"	Paris, Ont.
H. Phelan	"	Peterborough, Ont.
D. Fortye	"	"
H. Le Brun 2	"	"
C. H. Clements	"	"
E. Delaney	"	"
W. Fitzgerald	"	"
J. J. McBain	"	"
Robert Fair	"	"
J. Corkery	"	"
Isaac J. Wiser	"	Prescott, Ont.
T. Wickett	"	Port Hope, Ont.
J. Clemes	"	"
John Hume	"	"
T. A. Crane	"	Point Claire, Que.

Safford Radiators

References—*Continued.*

W. H. Pallister, residence, Port William, N.S.
W. Ross " Pictou, N.S.
Capt. A. Thompson " "
James A. Russell " "
Henry Ives " "
J. S. Harris " "
Mercer Murray " "
E. McPhail " "
James Thompson " "
H. H. Hamilton " "
Tanner & Sons " "
Gieve House " "
Louis Poulin " Quebec, Que.
Hon. Honore Mercier " "
John Simons " "
George E. Pare " "
Cyr Duquet " "
Thomas Lawrence " "
Mrs. A. Laurie " "
Dr. S. E. Grondin " "
Charles Gagnor " "
Claud Dion " "
F. X. Dion " "
A. Dion " "
Madame V. T. LaRiviere, residence, Quebec, Que.
C. O. Simard " "
A. Letellier " "
Dr. A. Marios " "
Elz. Charest " "
J. O. Pagean " "
D. Ouellet (architect) " "
E. d'Eschambault " "
J. B. Laliberte, office and warehouse "
E. E. Webb, residence "
St. Andrew's Church Manse, residence "
Mrs. J. Woodley " "
Mrs. M. DePreston " "
Mrs. Waddell " "
J. G. Ross & J. Gibb Est., warehouse "

J. Ritchie, residence, Quebec, Que.
E. Jones " "
Miss O'Leary " "
St. Matthew's Parsonage, residence "
P. Garneau, Fils & Cie, store "
George Tessier, residence "
J. N. Belliau " "
Alexander Lindsay " "
J. N. Millar " "
Ovide Granther " "
J. G. Boyce " "
L. G. Dumas " "
L. P. Sirois " "
Mrs. Lemieux & Cie, shop "
Mrs. Amos Bowen, residence "
Dr. J. W. Golicoeur " "
J. G. Couture, M.P. " "
Joseph Picard " "
Charles Pelletier " "
J. W. Gignac " "
S. N. Parent " "
Cyr Kiriceas " "
W. Brunet " "
Nap. Drouin " "
Joseph Cote " "
Gaspard Rochette " "
J. A. Fortin " "
Charles S. Riverm " "
Charles Dionne " "
Joseph Gagnon " "
A. B. Dupuis " "
Charles Bellerive " "
Charles Vezina " "
Charles Pettigrew " "
T. J. Delaney " Petite Riviere, Que.
C. G. Beautieu " Levis, Que.
Telesphore Beaulieu " "
Dame V. Tessier " St. Jean, Port Joli, Que.
Fred LaForrest " Edmuston, Que.

Joseph Rioux, residence, Trois Pistoles, Que.
Mr. Barr " Renfrew, Ont.
George Middleditch " Ridgetown, Ont.
John Marlatt, packing-house office "
Dr George Stanton " "
Dr. Smith " Simcoe, Ont.
E. C. Coleman " "
C. Bixel " Seaforth, Ont.
Mr. Proctor, stores, Sarnia, Ont.
Archibald McCallum, residence, St. Marys, Ont.
Dr. McLarty " St. Thomas, Ont.
J. Stacey " "
Journal Printing Co., office "
George Lloyd, store, St. Catharines, Ont.
R. McCallum & Son, office "
W. J. Smith, residence "
Mrs. Millar " "
Joseph Mills " "
Robert Lawrie " "
Richard Blank, residence, St. Catharines, Ont.
George Lloyd " "
Charles Case " "
Samuel Platt " "
John Murray " "
Dr. Jesson " "
James Chaplin " "
W. J. Chaplin " "
Dr. Leitch " "
A. McFarren " "
J. Clench " "
R. H. Smith " "
Rev. J. A. H. Allaine, residence "
Dr. L. Cruickshank " "
S. P. Gourlay " "
Hon. James Holbey " St. John, N.B.
Dr. James Berryman " "
Joseph Bullock, office "
J. M. Anderson, residence "
J. R. Stone " "

References—*Continued.*

James Jack, residence, St. John, N.B.
James H. Doody " "
H. P. Hayward " "
G. H. Waterberry " "
W. C. Pittfield " "
G. Fred. Fisher " "
G. R. Smith " "
Dr. H. E. Gillmore " "
William L. Prince " "
J. J. McCaffigan " "
W. C. Drurie " "
Joseph Bullock " "
Pugsley's Buildings, offices "
Queen Insurance Co. " "
Walker Building " "
Massey-Harris, office and warehouse, St. John, N.B.
Sir. Leonard Tilley, residence, St. John, N.B.
B. J. Driscoll " "
Felix McManus " "
Hugh H. McLean " "
J. H. Pullen " "
John McGinty " "
Dr. W. W. White " "
Falmouth St. Manse " Sydney, C.B.
Dr. McGillivray, residence and office, Sydney, C.B.
C. R. Rigby, residence, Sydney, C.B.
G. R. McKeene, residence, North Sydney, C.B.
Baptist Parsonage " "
J. W. Ingraham " "
Joseph Wood, M.P., store and office, Sackville, N.B.
H. Cooper, residence, Springhill, N.S.
Fred. Faulkner, residence, Stellarton, N.S.
W. G. Millar " "
Jno. McChanie " "
W. C. Trotter " St. Johns, Que.
H. N. Bernier " St. Hyacinthe, Que.
A. A. Tallion " Sorel, Que.
Geo. W. Dowker " St. Anne de Bellevue, Que.
Dr. Oldright " Toronto, Ont.

Rev. J. Hunter, residence, Toronto, Ont.
Professor Heys " "
Sir Adam Wilson " "
Dr. Aikins " "
Rev. G. M. Milligan, residence, Toronto, Ont.
William Mulock, Q.C., M.P., residence, Toronto, Ont.
Col. F. C. Denison, M.P. " "
Dr. G. S. Ryerson " "
Dr. L. M. Sweetman " "
Dr. Palmer " "
Rev. T. C. S. Macklem " "
Rev. Dr. Burns " "
Dr. Smith, V.S. " "
Dr. Davison " "
E. B. Osler, Q.C. " "
Major Carlaw " "
Dr. Avison " "
Rev. Elmore Harris " "
Charles Moss, Q.C. " "
Z. A. Lash, Q.C. " "
Dr. Czar " "
Major Gray " "
Captain Krangle " "
Robert Jeffrey " "
Dr. E. Bull " "
Dr. Larrett Smith " "
John I. Davidson " "
J. K. Kerr, Q.C. " "
Rev. John Alexander " "
Dr. Grafton " "
Harcourt Vernon " "
Warren Kennedy " "
Paul Campbell " "
Dr. Moorehouse 10 houses "
A. V. Delaporte residence "
J. H. Macdonald, Q.C. " "
Dr. Covernton " "
Hugh Ryan " "
T. Eaton " "

W. D. Matthews, residence, Toronto, Ont.
Dr. Bryce, block, store, and offices, Toronto, Ont.
James Carruthers, residence, Toronto, Ont.
Albert Gooderham " "
Alex. Manning " "
H. P. Dwight, 2 houses "
Edmund Wragge, residence "
T. R. Earl, 4 houses "
George A. Cox, residence "
Eugene O'Keefe " "
Alfred Beardmore " "
D. W. Alexander " "
G. L. Beardmore " "
George Gooderham " "
Gus. Thomas " "
Ambrose Kent " "
Chief Ardagh " "
John V. Reid " "
A. McArthur " "
John Drynan " "
E. J. Lennox, Architect, residence, Toronto, Ont.
J. Pugsley, residence, Toronto, Ont.
E. H. Duggan " "
H. L. Love " "
Jas. Crowther " "
Mrs. McGee " "
Mrs. Cawthra " "
Miss Gwynn " "
Mrs. Durie " "
Mrs. E. Stanley " "
Mr. Van Every " "
Mrs. M. McArthur, residence. Toronto, Ont.
G. A. McKenzie " "
D. E. Thompson " "
W. S. Thompson, 4 houses "
A. C. Thompson, 4 " "
Adam Armstrong, 2 " "
J. B. Davidson, store and residence, Toronto, Ont.
Fred. A. Stewart, residence, Toronto, Ont.

Safford Radiators

References—*Continued.*

R. M. Gray, residence, Toronto, Ont.
L. A. Morrison " "
Robert Davies " "
John Donagh " "
E. Buchan " "
P. W. Atkinson " "
T. R. Wood " "
Thos. Long " "
George Gall " "
George Goulding " "
Jno. Rennie " "
B. Rosamond " "
Henry Swan " "
James Swift " "
W. D. Gillean " "
T. Kinnear " "
P. McCrae " "
Irwin Walker " "
W. Davidson " "
W. Williamson " "
Thos. A. Gregg " "
S. E. Townsend " "
Thomas Sauden " "
C. H. Rundle, 6 houses "
F. F. Pickering, 3 " "
A. L. Anderson, 2 " "
Frank Arnoldi, 2 " "
Geo. McKibbon, 2 " "
Brown & Love, 2 " "
Dancey Bros. 2 " "
Farquhar & Co., 2 " "
C. R. S. Dinnick, 5 " "
John Scully, residence "
M. McConnell " "
J. P. Murray " "
W. J. Gage " "
A. J. Somerville " "
George Laidlaw " "
Duncan Coulson " "

Henry Winnett, residence, Toronto, Ont.
John Lumbers " "
John F. Taylor " "
Chas. Cluthe " "
Lewis Lukes " "
J. O. Thorne " "
Daniel M. Defoe " "
Richard Brown " "
G. M. Millar (architect), residence, Toronto, Ont.
H. B. Gordon " "
Wm. Davies, residence, Toronto, Ont.
H. J. Scott " "
Chas. Lindsay " "
A. K. Ray " "
J. T. McCabe " "
Wm. Levack " "
Chas. Wilson " "
J. L. Brodie " "
Jas. Morrison " "
J. W. G. Whitney " "
Robert Forbes " "
A. H. Rundle " "
G. B. Smith " "
H. Gordon McKenzie, residence, Toronto, Ont.
G. A. Elliott " "
Bedford & Sons " "
Wm. White " "
Jno. Poucher " "
A. Thornton Todd " "
J. A. Roe " "
W. J. Guy " "
A. M. Wickens " "
J. K. Fairbairn " "
G. L. Hillman 2 houses "
H. P. Blachford residence "
T. R. Woods " "
John Bradshaw " "
F. N. Walker " "
Richard Dinnis & Son " "

E. A. Meredith, residence, Toronto, Ont.
N. N. Miller " "
John Bain " "
Alex. Fraser " "
Mrs. Webster " "
Mr. Niddrie " "
F. N. Kingston " "
R. F. Pieper " "
Alex. Cameron " "
T. F. Blackwood " "
G. W. Hunter " "
T. C. O'Callaghan " "
E. Boronow " "
W. H. Adamson " "
Joseph Wright " "
S. C. Moore " "
Charles Langley " "
James Black " "
James Henderson " "
John Buchan " "
George P. McGann " "
Thomas Bell " "
John Russell " "
J. G. Cook " "
Thos. Cuthenden " "
Mr. Matheson " "
Mr. Nordheimer " "
Mr. Dale " "
Mrs. Kent " "
Sherman E. Townsend " "
J. D. Nasmith, 2 blocks, stores and offices, Toronto, Ont.
S. H. Janes, offices, Toronto, Ont
Adamant Manfg. Co., offices, Toronto, Ont.
C. P. R. Telegraph " "
Davidson & Henderson, warehouse, Toronto, Ont.
D. McCall & Co. " "
R. Walker & Sons, stores "
R. & T. Watson, offices "
Gunn, Flavelle & Co., office "

References—*Continued.*

Robert Thompson, office,	Toronto,	Ont.
George Constable, 2 stores	"	
R. J. Barrow, store and residence	"	
James Morrison, warehouse	"	
Rice Lewis & Son, stores	"	
Frank Hayden, residence	"	
J. B. Andrews, residence	"	
W. C. Harris "	"	
Vacuum Oil Co., offices	"	
Mr. Pratt, residence	"	
John Abell "	"	
H. D. Warren, residence	"	
W. G. P. Cassells "	"	
Wm. Muir "	"	
Wm. Boultbee "	"	
C. C. Wichall "	"	
Mrs. Love, restaurant	"	
W. C. Cormack, residence	"	
Mr. Matthews "	"	
T. R. Labelle "	"	
R. & S. Jenkins "	"	
O. Midgley "	"	
Mrs. M. J. Macdonald "	"	
W. L. Symons "	"	
C. G. Begg "	"	
Miss Round "	"	
T. Watson "	"	
Pellatt & Pellatt, office	"	
W. A. Firstbrook, residence	"	
George A. Chapman, residence	"	
J. P. Murray "	"	
R. Millichamp "	"	
A. M. Rice "	"	
R. N. Gooch office	"	
J. T. McCabe residence	"	
Steele Bros. & Co., warehouse	"	
M. R. Beard "	"	
E. Bickford residence	"	
L. E. Embriee "	"	

S. F. Kilgour, residence,	Toronto,	Ont.
A. J. Thompson	"	"
John Mallon	"	"
C. H. Ritchie, Q.C.	"	"
T. B. Wadsworth	"	"
James Harold	"	"
J. D. Oliver	"	"
Mason & Risch, piano factory		"
Warwick & Son, warehouse		"
Major Carlaw "		"
Cowan & Co.	"	"
D. Wagstaff, residence		"
C. S. Williams "		"
Ex.-Ald. Atkinson, 2 "		"
Mr. Fennell "		"
J. S. Hamilton "		"
J. J. Follett "		"
John Lea "		"
H. Heintzman "		"
Fred Crompton "		"
Pugsley, Dingman & Co., warehouse		"
G. R. Cummings, store and residence		"
N. W. Glendon, residence		"
J. L. Thompson "		"
W. S. Thompson "		"
McGuire & Bird, store and shop		"
J. L. Thompson, store and offices		"
J. E. Thompson, Alphonso Block		"
H. Stephenson, residence		"
T. Crittendean, store and residence		"
J. Sim & Co. "	"	"
Thomas Smellie, residence		"
J. Sim	"	"
R. Dunn	"	"
T. O. Rowan	"	"
R. M. Scott 3	"	"
Matthew Evans	"	"
John Abell	"	"
C. H. Hubbard	"	"

Coffee House, Elm St., residence,	Toronto,	Ont.
G. A. Devaney "	"	
Moore Estate, warehouse		"
John Paton, residence		"
J. McCormack "		"
Dr. Rae "		"
Hon. A. M. Ross "		"
C. J. McCuaig "		"
Thomas A. Lytle "		"
G. R. H. Holmes "		"
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Mr. McDermid "		"
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W. D. Matthews "		"
Mr. Leys "		"
Mr. Wilson "		"
W. Davies & Co. "		"
Sir David Macpherson "		"
Shearer & Brown "		"
Dr. Thorbourn "		"
Mr. Todd "		"
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Dr. Carlyle "		"
Mr. Whitton "		"
N. D. Matthews "		"
John Sloan "		"
Mr. Davidson "		"
S. Pearcy "		"
J. J. Brown "		"
Mr. Hoyle "		"
A. McFarren "		"
Mr. Muir "		"
Mr. Macklem "		"
Mr. Warren "		"
—, Grassett "		"

Safford Radiators

References—*Continued.*

A. J. Brown,	residence,	Toronto, Ont.
Mr. Riordan	"	"
Mr. Goulding	"	"
F. J. Phillips	"	"
Chief Stewart	"	"
Mrs. Love	"	"
H. W. Darling	"	"
H. A. Walker	"	"
E. Y. Eaton	"	"
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Dr. Cotton	"	"
F. W. Doty	"	"
Mr. Frankland	"	"
Mr. Bowes	"	"
John Lee	"	" (Deer Park)
J. C. Scott	"	"
John Hudson	"	"
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Mr. Bott	"	"
		"

Thomas Dunn,	residence,	Vancouver, B.C.
Holland Block		"
Five Sisters' Block		Victoria, B.C.
Davie Block		"
Ward's Building		"
Maynard Building		"
Fai Yure Block		"
A. C. Gellately,	residence	"
James Dunsmuir	"	"
G. H. Burns	"	"
Joseph Sayward	"	"
James Muirhead	"	"
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Mrs. A. Adams	"	"
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Dr. Powell	"	"
Thomas Hooper	"	"
Major Dupont	"	"
Frank Adams	"	"
Thomas Shotbolt	"	"
J. W. Carter	"	"
C. J. Cooley	"	"
Sir M. B. Bigbie	"	"
Bowlby Bros.	"	Waterford, Ont.
Mr. Robin	"	Walkerville, Ont.
Mr. Reid	"	"
J. Walker & Sons	"	"
H. A. Walker	"	"
Squire Rohns	"	Windsor, Ont.
Capt. Sharks	"	"
E. H. Mann	"	"
F. S. Evans	"	"

Dr. McKay,	residence,	Woodstock, Ont.
Rev. Mr. McKay,	store	"
Dr. Wellford	"	"
William Millman,	store	"
George Caldkirk	"	"
T. Cuthbertson,	residence	"
G. L. Hobson	"	Welland, Ont.
F. Colquhoner	"	Waterloo, Ont.
Senator W. A. Sanford	"	Winnipeg, Man.
W. Chesterton (architect)	"	"
Dean Grisdale	"	"
H. M. Howell	"	"
G. J. Maulson	"	"
W. H. Nicoll	"	"
A. H. Mathewson	"	"
L. M. Lewis	"	"
F. T. Kirby	"	"
M. Aldous	"	"
W. A. Mettleberry	"	"
W. H. Mathews	"	"
J. N. Rogers,	store	"
Stobart, Sons & Co.,	wholesale block	"
Dr. De Wolf Smith,	residence,	New Westminster, B.C.
A. J. McColl	"	"
Corbould & McColl,	stores	"
Dr. Moody,	residence,	Windsor, N.S.
G. D. Gildert & Co.,	store	"
G. P. Payzant,	office	"
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George Wilcox	"	"
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G. W. Bradshaw	"	"
Rev. A. Cahoon	"	Wolfville, N.S.
S. A. Crowell	"	Yarmouth, N.S.

USEFUL INFORMATION

Pertaining to the System of

Hot Water and Steam Heating and Ventilation

. . . Compiled by . . .

JOHN M. TAYLOR, Secretary and General Manager

. . . . . for . . . .

The Toronto Radiator Manufacturing Company, Ltd.

Assisted by the Works of

HASWELL, BALDWIN, BOX, HOOD, and others.

We shall be pleased to give further information to our friends on the above subjects on receipt of enquiry.

Hot Water Heating

Theory of Circulation.—That all falling bodies gravitate with the same velocity, and therefore descend through a certain definite space in a given time, is an effect of which gravity is the cause; by it the circulation of hot water is attained. This circulation causes all the water in an apparatus to pass successively through the boiler, and then communicates the heat received to the various apartments to be warmed.

In an apparatus for warming, when heat is applied to a boiler, the water becomes lighter, and the water in the lower or return pipe of the apparatus being colder and heavier presses with a greater weight than in the boiler.

By means of this unequal pressure in the lower pipe, the water is forced to circulate through the apparatus, and it will continue to do so as long as the water in the returns has a lower temperature than that in the boiler and flow pipes, and as one is continually receiving heat while the other is as constantly parting with it an equality of temperature never can occur; if it did, the circulation would cease. So we find the circulation of water in an apparatus is caused by the unequal pressure in the "up" and "down" pipes, and is not the result of any alteration in the level of the water contained.

A greater permanence of temperature may be obtained by hot water than by any other method, and it is also superior in its economy of fuel.

The relative weight of steam and water at 212° is about as one is to 1,640. So that a pipe filled with water at 212° contains 1,640 times the matter that it does when filled with steam. When the temperature of the steam falls below 212° condensation begins, and continues until all its latent heat is abstracted; it then contains a heating power of an equal bulk of water, or as quantity occupying $\frac{1}{1640}$ part of space the steam did. The specific heat of steam, as compared with that of water, is for equal weights as .847 is to 1, and taking the latent heat of steam at 1,000° the relative heat from equal weights of condensed steam and water by reducing their temperatures from 212° to 60° is as 7.425 is to 1, but for equal bulks it will be as 1 for steam to 228 for water; therefore, steam will lose as much heat in one minute as the same bulk of water will lose in $3\frac{3}{4}$ hours.

The colder the water in the descending pipes, as compared with that in the boiler, the more rapid will be the circulation through the pipes.

The gravitating force of an apparatus is inversely proportioned to the temperature; that is, it is less as the temperature is greater.

Provision must be made for the escape of air in the pipes, else no circulation can be had. Water while boiling evolves air, and when cooling it imbibes it again; and as the air is lighter than water, it lodges in the high parts of the circulating pipes, and allowance must be made for its escape or for carrying it off.

With closed boilers, pipes may be carried to any height, depending only on the strength of the material employed. The higher the ascending and descending pipes are run, the more rapid will be the motion of the water, because of the greater difference in their weights.

The pressure by water is calculated by its columnar height reckoned from the bottom of the vessel, and this pressure on each square inch of surface increases at the rate of about half a pound for every foot of perpendicular height.

Neither the principle nor practical working of an apparatus is in the least affected by having any additional pipes leading into or out of the boiler. The effect is the same with more flows than returns, and conversely.

Increasing the number of vertical branches does not increase the pressure in an apparatus if the vertical height is not increased.

Law of Velocity of Flow.—The motive power of the circulation in a hot water apparatus is the difference between the specific gravities of the ascending and descending pipes. This effective pressure is very small, and is equal to about one grain for each foot in height for each degree difference between the pipes; thus, with a height of 12″ in "up" pipe, and a difference between the temperatures of the up and down pipes of 8°, the difference in their specific gravities is equal to 8.16 grains on each square inch of the section of return pipe, and the velocity of the circulation is proportioned to these differences in temperature and height.

To calculate velocity of flow.—Thus, with a height of ascending pipe equal to 10′, and a difference in temperatures of the flow and return pipes of 8°, the difference in their specific gravities will equal 81.6 grains, or ÷ 7000 = .01166 lbs., or × 2.31 (feet of water in one pound) = .0269 feet, and by the law of falling bodies the velocity will be equal to $8\sqrt{.0269} = 1.312$ feet per second, or × 60 = 78.7 feet per minute. In this calculation the effect of friction is entirely omittted. Considerable deduction must be made on this account. Even in apparatus where length of pipe is not great, and with pipes of larger areas, and with few bends or angles, a large deduction for friction must be made from the theoretical velocity, while in large and complex apparatus with small head, the velocity is so much reduced by friction that sometimes as much as from 50 to 90 per cent. must be deducted to obtain the true rate of circulation.

Velocity modified by areas of pipe.—The motive power of the circulation increases with the size of pipe: that in 4″ being 4 times that in 2″, or about as their areas, but resistance also increases in the same ratio, so that the actual working effect is the same in pipes of all sizes.

Friction of water in pipes varies according to their arrangement and size, being much greater in small than in large pipes, because of greater surface the water contained is in contact with, and its increased circulation, on account of its more rapid cooling. By increasing velocity, the friction is increased nearly as the square of the velocity.

Water loses less of its heat in small than in large pipes, since it travels more rapidly, and the loss of heat by water is directly as the time and the surface conjointly.

To Increase Activity of Circulation.—There are two ways of increasing the effective or motive power, viz., by causing water to cool a greater number of degrees by transit through greater length of pipe, or by exposing it to more surface in proportion to water contained in pipes; and, second, by increasing the vertical height. This last is principally depended upon when additional power is required to overcome obstructions.

If the circulation be doubled in velocity, the water will pass through the same length in half the time, and lose only one-half as much heat, because the rate of cooling is not proportioned to the distance through which water circulates, but to the time of transit.

Increased velocity is indicative of increased power, and in hot water apparatus it is increased velocity which overcomes unusual obstructions.

Care must be taken in arranging pipes, so that water in its descent may not be obstructed by differences of level or angles where air may accumulate, for this effectually prevents circulation by dividing the streams.

Friction increases with velocity, but the latter is checked by friction, and so a mien rate is assumed.

Flow Pipes.—All the flow pipes in an apparatus should have an upward pitch toward the heaters, and the return pipes a downward one toward the boiler; in either case about 1 inch in 20 feet will answer.

Pressure in pipes does not aid circulation, because the back pressure always equals the pressure ahead.

Since difference in the temperatures of the two columns is essential, the water should rise as much as possible directly it leaves the boiler, while it is hottest and lightest, and do most of its falling just before entering the boiler, when coldest and heaviest; and, as the motive power at best is small, every advantage should be taken of it. Flow pipes should be covered to retain heat to point where they are to be used. With the return pipe it is not important, as any loss of heat is compensated for by increased circulation.

The advantage of conveying the water through ascending pipes from boilers is twofold. It allows the freest escape for the air and steam, which prevent circulation, and also facilitates the circulation by increasing the actual and relative weight of the descending column.

Horizontal Pipe.—The distance through which water will circulate in an apparatus is very considerable; the limit has not been ascertained, as the higher it rises above the boiler, the greater distance it will circulate. Generally, it is best to shorten circulations, and an apparatus will be more efficient if run through two or more short than through one long circulation; for while impediments are overcome by considerable differences in temperatures, the apparatus is most satisfactory when they do not differ widely.

When a boiler is placed considerably below the pipes and other surfaces, the circulation is sure to be rapid, and the circulation should be as short as possible, to have but little difference in temperature of flow and return pipes; but when boiler is placed nearly on the level of the pipes, it is often necessary to have greater differences in the temperatures, so as to secure a good circulation.

Horizontal leading pipes require to be much larger in proportion to their branches than is necessary with vertical leading or main flow pipes, because the friction in an upward pipe is exceedingly small.

Frequently pipes branching from an upright are required to circulate at different levels, as in the warming of several floors; then either one of two methods may be adopted. First, the mains are run to the highest level, and passing round such room descend to and circulate through each of the lower floors in turn, finally returning to the boiler; or each floor may have a separate range of pipes branching out of a main upright supply. By the first method the upper floors receive most of the heat, while the lower ones warm slowly. In the second method, if the laterals are taken at right angles from the upright main, the whole of the water is apt to rise to the upper floor, because of the rapidity with which water circulates in an upright pipe. This may be obviated by arranging checks or valves at the points of the lateral branches, or each floor may have a separate supply pipe rising directly from the boiler to each floor.

Surface in Boilers.—The extent of surface which a boiler should expose to the fire should be proportional to the quantity of pipe to be heated, and a small apparatus should have more surface of boiler in proportion to length of pipe than a larger one, as the fire is less intense and burns to less advantage in a small furnace than in a large one.

It is more economical to work with larger surface of boiler at moderate heat than to keep the boiler at its maximum temperature.

Boilers for hot water apparatus should expose the largest surface to the fire in the smallest space.

They should so effectually absorb the heat from the fuel that as little as possible may escape by the chimney.

They should allow the freest circulation of water throughout their entire extent.

They should not easily get out of order, nor rapidly deteriorate by continued use.

There is no advantage gained in using boilers containing a larger quantity of water than is required for the work to be done. The boilers are always full, the lower pipe bringing the supply of cooled water as fast as the ascending pipe carries off the warmed water.

When the water in an apparatus has been raised to the temperature at which it is desired to run it, no more fuel is necessary to maintain it at this point, if the boiler, circulating mains, and radiators contain a large volume, than if a small quantity.

It is desirable, however, that the cubic feet of water in an apparatus should be small, for the reason that in the first heating it, more fuel is required to bring it up to the desired point, and in cooling an excess of heat may have to be used before the temperature falls to where it is wanted.

All Radiators should be placed as near the cooling surfaces—the windows and outer walls—as possible, to prevent currents of cool air across the floors. The kind of Radiator is very important. "Safford" cast-iron Radiators are considerably more effective than wrought iron Radiators, and are therefore recommended.

Valves and Connections.—Every Radiator or coil should be provided with a valve, which may be placed either on the flow or return pipe, for controlling the circulation and regulating the amount of heat given out.

All Radiator and other valves in the circulating system should be best quality valves, having full openings to permit the free passage of the water.

Air cocks must be placed at the highest point on all Radiators or coils to permit of the escape of air when the system is filled, or the admission of air when the system is to be emptied.

Sizes for Radiator Connections

1"	will supply a	Radiator	containing	50	square feet	of surface.
1¼"	"	"	"	125	"	"
1½"	"	"	"	250	"	"

Sizes of Mains.—All piping should be laid out with reference to the free passage of the water in the pipes, which will be aided largely by the use of "Y's," 45°s and long bends, instead of elbows, tees, etc.

Friction in the pipes hinders circulation, and for this reason no smaller pipes than 1" should be used.

Main flow pipes from the heater, from which branches may be taken, are to be preferred to the practice of taking off nearly as many pipes from the heater as there are Radiators to supply.

It is not necessary that the main flow and return pipes should equal in capacity that of all their branches. The hottest water will seek the highest level, while gravity will cause an even distribution of the heated water if the surface is properly proportioned.

It is good practice to reduce the size of the vertical mains as they ascend, say at the rate of one size for each floor.

As with steam, so with hot water, the pipes must be unconfined to allow for consequent expansion of the pipes on having their temperatures increased.

An expansion tank is required to keep the apparatus filled with water, which latter expands $\frac{1}{24}$ of its bulk on being heated from 40° to 212°, and the cistern must have capacity to hold certainly this increased bulk. It is recommended that the supply cistern be placed on level with or above the highest pipes of the apparatus, in order to receive the air which collects in the mains and Radiators, and capable of holding at least $\frac{1}{20}$ of the water in the entire apparatus.

There are two distinct forms of modifications of hot water apparatus, depending upon the temperature of the water.

In the first or open tank system the water is never above 212° temperature, and rarely above 200°. This method always gives satisfaction where the surface is sufficiently liberal, but in making it so its cost is considerably greater than a steam-heating apparatus.

The second method is sometimes called (erroneously) high-pressure hot water heating, or the closed system apparatus.

This form need not be high pressure. For ordinary steam heating a higher pressure than 10 lbs. is rarely used, and with no thought of danger. In a hot water apparatus with closed system and with a safety valve set to discharge at a pressure of 10 lbs on the expansion tank, there would be no kind of danger to be feared; its temperature would be about the same as with 10 lbs. steam, and the surfaces of boiler and Radiators and other proportions would not require to be any larger or more costly than a steam apparatus, while it would be quite as effective.

Water that has been boiled freezes sooner than water that has not been boiled.

When salt water is used in an apparatus, the effect produced on cast or wrought-iron pipes and boilers by 10 per cent. of salt in solution would not be of much importance, although in process of time the apparatus would corrode in some degree. After an apparatus is once filled with salt water, any waste that occurs should be replaced by fresh water.

The larger the quantity of salt in water, the greater is the degree of cold required to freeze it. Water containing 3 per cent. of salt in solution congeals at 28°, with 6 per cent. at 25.5°, and with 11 per cent. it would freeze at 21½°.

Water at medium temperature can hold in solution nearly 36 per cent. of common salt, and at its boiling point nearly 40 per cent.

Water will receive heat from iron 2.6 times as rapidly as iron will receive it from the fire.

. . . AIR . . .

Atmospheric air is a mechanical mixture—not chemically combined—and when in its purest state consists of oxygen 20.96, nitrogen 79, and carbonic acid gas .04.

One cubic foot at temperature of 32° Fahr. under a pressure of 14.7 lbs. or 30" of mercury weighs 565.1 grains or .0807 lb., and 1 lb. is equal to 12.387 cubic feet. Its weight varies about 1 grain for each degree of heat. It is 773 times lighter than water at 32° Fahr.

The mean weight of a column one foot square and of an altitude equal to the height of the atmosphere weighs 3124.7 lbs., or ÷ 144 = 14.7 lbs. per square inch, or ÷ 62.5 it will support a column of water about 34 feet high, or ÷ 846 lbs. (weight of 1 cubic foot of mercury) it will support a column of mercury 30 inches high.

The vital element in air is oxygen gas, which is remarkable for its wonderful energy, and requires nearly four times its weight of nitrogen to dilute it sufficiently to meet the requirements of life. The volume of oxygen in equal bulks of air varies with its temperature; thus dry air at 85° contains 10 per cent. less than at 32°, and when saturated with vapor the difference is 12 per cent.; so that if in winter 1500 feet of air is required, in summer 1650 feet will be necessary to supply the same quantity of oxygen. An average man requires about 1 cubic foot of oxygen per minute for respiration, and this quantity is contained in about 5 cubic feet of common air.

The motions of air and all gases are precisely alike to those of fluids.

The temperature of the air at the surface of the earth varies with the geographical position, local circumstances, and with the height above the sea level. The influence of elevation above the sea is very considerable, varying with the climate, season, and general contour of the ground.

When the slope is gradual the cold produced is about 1° for 430 feet; on steep mountain slopes 1° in about 355 feet, and balloon ascensions 1° in about 330 feet.

The temperature of the surface of the ground follows closely that of the air, but at a certain depth there is a stratum, the temperature of which is invariable throughout the year, and is equal to the mean temperature of the air at that place. Below this the heat increases about 1° for every 58 feet of depth; so that if at the surface the temperature is 62°, water would boil at 212° − 60° × 58 = 8700 feet, or ÷ 5280 at 1.647 miles.

The rate of expansion of air and all other elastic fluids for all temperatures and densities is essentially uniform; from 32° to 212° or 180° they expand from 1000 to 1376 = .00209, or $\frac{1}{478}$ part of their bulk or volume for each degree, and from 212° to 680° they increase in volume from 1376 to 2322, or .00202 per degree.

The specific heat of air under 30" of mercury with constant pressure is .238, water being 1.00. When heated with constant volume, the pressure is increased, and the specific heat is less than when expansion is permitted.

. . STEAM . .

Steam is pure water expanded by heat into an invisible vapor. Perfect steam is in no way moist, but is as dry as are the permanent gases It has in a complete degree those properties of fluidity, mobility, elasticity, and quality of pressure, in every direction that distinguishes gases.

Saturated steam is the normal condition of steam generated in free contact with water, and the same density and same pressure always exist in conjunction with the same temperature. It therefore is at both its condensing and generating points, *i.e.*, it condenses if its temperature is reduced, and more water is evaporated if its temperature is raised.

The pressure and density of steam, generated in free contact with water, rise with the temperature, and reciprocally as temperature rises with the pressure and density, the higher the temperature the more exactly proportionate to the variations of temperature. Under this condition, steam is termed "saturated" from its containing the largest amount of water possible at any given temperature.

The pressure of steam at a boiling point of 212° is equal to the pressure of the atmosphere, which is 14.7 lbs. upon a square inch.

The expansive force of the vapor of all fluids is the same at their boiling points.

A cubic inch of water evaporated under ordinary atmospheric pressure is converted into 1.640 cubic inches of steam, nearly 1 cubic foot, and it exerts a mechanical force equal to raising $14.7 \times 144 = 2{,}120$ lbs. 1 foot high.

One pound pressure of steam will support a column of mercury = 2.0376 inches high.

The boiling point of water varies with the pressure of the atmosphere or vapor under which it is effected.

Steam for heating purposes possesses an advantage over hot water in the case of its application where great inequalities and frequent alterations of level occur, and particularly when the boiler must be placed higher than the place to be heated. For buildings occupied at intervals, steam is more effective than hot water in its rapid generation of heat.

The most prominent of the properties of steam are its high expansive force, its condensation by the abstraction of its temperature, its concealed or undeveloped heat, and the inverted ratio of its pressure to the space it occupies.

The expansive force of steam arises from the absence of cohesion between and among the particles of water. If a known volume of steam of a certain pressure be made to occupy but one-half of its volume, its elastic power will be doubled.

Steam has an expanding force always equal to the pressure under which it is generated, and its temperature theoretically is always the same as that of the water in contact with it.

The sum of its sensible and latent heat is always the same and is equal to 1146° above the freezing point of water.

Under ordinary atmospheric pressure 27.222 cubic feet weigh one pound, and it has a gravity about equal to one-half that of air at 34°; but if the temperature of air be increased 160°, the gravity of steam will equal two-thirds of the weight of air.

SIZES OF MAIN STEAM AND RETURN PIPES.

Radiating surface in square feet to be supplied.	Size of steam pipes.	Size of return pipes.
125	1¼	1
125 to 200	1½	1¼
200 to 500	2	1½
500 to 1000	2½	2
1000 to 1500	3	2½
1500 to 2500	3½	3

When mains and surfaces are very much above the boiler, the pipes need not be as large as given above. Under very favorable circumstances and conditions a 4-inch pipe may supply from 2,000 to 2,500 feet of surface, a 6-inch pipe for 5,000 feet, and 10-inch pipe for 15,000 to 20,000 feet if the distance of run from boiler is not too great. Less than 1½-inch pipe should not be used horizontally in a main unless for a single radiator connection. The return sizes named are large enough in ordinary pipe work, though when horizontal pipes with many fittings are used they should be of the same diameter as the steam pipes.

. . HEAT . .

Heat is simply a mode of motion, or an influence by which motion is produced among the atoms of substances. The motion is imperceptible, heat being detected only by sense of feeling.

It is a universal force, and is referred to as cause and effect. Heat and cold are conditions, and not substances. They are relatively, not absolutely, different, being merely higher or lower degrees of heat.

The three most apparent effects of heat, so far as they relate to the form and dimensions of bodies, are expansion, liquefaction, and vaporization. Its effect is most evident in those bodies which are the least influenced by the attraction of cohesion; thus in solids it is comparatively trifling, in liquids it is much greater, while in gases it is very considerable.

The force with which bodies expand and contract under the influence of an increase or diminution of heat is irresistible, and is one of the greatest forces in nature.

The ratio of expansion in solids and liquids increases with the temperature, while in gases it is sensibly uniform at all temperatures.

A unit of heat is the quantity of heat necessary to raise 1 lb. of water 1° F

Specific heat is the capacity of a body for heat, and is the number of heat units necessary to raise 1 lb. of any substance 1°. The specific heat of all bodies, except gases, increases with their temperatures.

Latent heat is the number of heat units absorbed by any body in passing from a solid state to a liquid, or from a liquid to a gaseous condition.

Heat is transmitted or lost—

By radiation—projected in rays and in straight lines.

By convection—rising in fluid masses or through flues.

By conduction—passing from one body to another in contact.

The heat necessary to warm a pound of water 1° will warm about $1\frac{2}{16}$ lbs. of air 1°, or $2\frac{1}{16}$ lbs. of vapor of water, or 9 lbs. of iron, or nearly 2 lbs. of ice, one degree. The heat necessary to convert 1 lb. of water from 178° (which is about the temperature of return water) to steam is about 1,000 units, and this will heat 52,000 cubic feet of air 1°, or 5,200 cubic feet 10°, or 52 feet 100°, without making allowance for the increase of its bulk because of its expansion, which for a difference of 100° will equal nearly 20 per cent. of its original bulk.

. . WATER . .

Whether as a solid, liquid, or gas, water is one of the most wonderful substances in nature. At all temperatures above 32° F. the motion of heat is sufficient to keep its molecules from rigid union; but at 32 the motion becomes so reduced that the atoms seize upon each other and aggregate to a solid.

It is composed by a chemical union of oxygen and hydrogen in the proportions of:

By weight, oxygen, 88.9 parts; hydrogen, 1.11 parts.
By volume, " 1 " " 2 "

Liquids transmit pressure equally in all directions, unchanged and without loss of power. This equality of pressure is their most characteristic property.

Water when heated from 40° —which is nearly the temperature at its maximum density—to 212° expands .0466 times its volume, or .00027 of its bulk for each degree, making its increase for 180° equal to 1 cubic foot in 21.41 feet. Below 39.1°, its point of maximum density, its ratio of expansion decreases at first slowly, but progresses rapidly to the point of congealation, where it suddenly expands .0855 of its volume; a cubic foot of ice weighing 57.5 lbs., or about 5 lbs. less than when at 40° temperature. At 46° it has about the same volume as at 32°.

It is compressible at the rate of about $\frac{1}{21\frac{1}{2}\frac{1}{40}}$ or about $\frac{1}{100}$ of an inch in $18\frac{1}{10}$ feet by each atmosphere or pressure of 15 lbs. per square inch. When the pressure is removed, its elasticity restores its original bulk. By compression, Mr. Perkins, of London, required a pressure of 15,000 lbs. to reduce water $\frac{1}{24}$ part of its volume. Water at 39.1° is taken as the unit of weight upon which the specific gravity of steam is based.

A standard gallon at 39.1° Fah., Barometer at 30" mercury, weighs 8.34 pounds, and is equal to 231 cubic inches.

A pound of distilled water at 39.88°, Bar. 30", is equal to 27.7 cubic inches, and a cubic inch weighs 252.69 grains. A cubic foot contains 7.48 gallons, and at 39.83° weighs 998 ounces or 62.83 lbs. advoirdupois, and is 828 times heavier than atmospheric air. For ease of calculation, its weight is taken as 1,000 ounces or 62.5 lbs.

Water at 1,000 ounces is assumed as unity in the comparison of gravity of different substances.

It evaporates at all temperatures, dissolves more substances than any other agent, and has a greater capacity for heat than any other known substance except hydrogen gas.

Twenty volumes of water absorb one volume of air under atmospheric pressure.

A miner's inch is a measure for the flow of water, and is an opening 1" square through a plank 2" thick under a head of 6" of water to the upper edge of the opening. It will discharge $11\frac{5}{8}$ gallons in one minute.

A cylinder $3\frac{1}{2}$ inches in diameter and 6 inches high will hold almost exactly one quart, and one 7 inches in diameter and 6 inches high will hold very nearly one gallon.

The ratio of fresh water to salt water is about as is 36 to 35 by weight.

RADIATION OF HEAT

Radiation of heat is diffusion of heat by projection of it in right lines into space, from a body having a higher temperature than space surrounding it, or body or bodies enveloping it.

Radiation is affected by nature of surface of body; thus, black and rough surfaces radiate and absorb more heat than light and polished surfaces.

Bodies which radiate heat best absorb it best.

Radiant heat passes through moderate thicknesses of air and gas without suffering any appreciable loss or heating them. When a polished surface receives a ray of heat, it absorbs a portion of it and reflects the rest. The quantity of heat absorbed by the body from its surface is the measure of its absorbing power, and the heat reflected that of its reflecting power.

When temperature of a body remains constant it is in consequence of quantity of heat emitted being equal to quantity of heat absorbed by body.

Reflecting power of a body is complement of its absorbing power; or, sum of absorbing and reflecting powers of all bodies is the same. Thus, if quantity of heat which strikes a body = 100, and radiating and reflecting power each 90, the absorbent would be 10.

CONDUCTION OR CONVECTION OF HEAT

Air and gases are very imperfect conductors. Heat appears to be transmitted through them almost entirely by conveyance, the heated portions of air becoming lighter, and diffusing the heat through the mass in their ascent. Hence, in heating a room with air, the hot air should be introduced at lowest part. Convection of heat refers to transfer and diffusion of heat in a fluid mass, by means of the motion of the particles of the mass.

STEAM HEATING

The method of warming buildings by steam depends upon the rapid condensation of steam into water when admitted into any vessel which is not so hot as itself. At the moment of condensation the latent heat of the steam is given out to the vessel containing it, and thus diffuses the heat to the surrounding space.

A low-pressure gravity apparatus is the most healthful, economical, cleanly, and perfect heating appliance known, and may be constructed to heat a single room or the largest building with a uniformity that cannot be attained by any other means.

A gravity apparatus is one without an outlet whose circulation is perfect, wasting no water and requiring no mechanical means for returning the water of condensation to the boiler. It has been very properly likened unto the circulation of blood in the human system.

This form of apparatus is extensively employed in warming private houses, churches, schools, and other public buildings, with very satisfactory results. Its chief merits are its safety, noiselessness, the ease with which it is managed, the low and uniform temperature of its surfaces, and the positive return of the water of condensation to the boiler under all conditions.

A Low Pressure Gravity Circulation Apparatus consists of—

The Boiler, with its various attachments for the automatic regulation of its draughts and pressures.

Main Steam Pipes and Risers for conveying the steam to the various parts of a building to be warmed, and the corresponding return risers and mains for the return of condensation to the boiler.

Relief Pipes for relieving the mains and risers of the water of condensation, and for equalizing the pressure throughout the apparatus.

Safford Radiators for the several rooms to be warmed, with their necessary valves and connections.

There are Two Systems by which the steam may be communicated when desired.

1st. *By direct radiation*, consisting of radiators, as illustrated on pages 8 to 39, placed within a room or building to warm the air and maintain its temperature. This system is not connected with any definite method of ventilation.

2nd. *By indirect radiation*, embracing all heating surfaces placed outside the rooms to be warmed, and can only be used in connection with some system of ventilation. This form of surface warms only the air that passes into a room, and has to raise the temperature of all the air admitted to that neces ary to maintain any desired temperature, and make up the loss by ventilation. This surface is generally divided into many parts placed near the lower ends of vertical flues leading to the several rooms to be warmed. For this method of surface a building should be arranged especially with some definite system of flues sufficient to change the entire air of an apartment at least once in an hour.

There are Five Systems by which a building may be furnished with circulating pipes for a steam apparatus.

1st. *With main steam pipes and risers*, with accompanying return pipes. When properly constructed, and with pipes of sufficient area, this method will work satisfactorily at any pressure, and is the system usually employed in large buildings.

2nd. *With main steam pipes and risers*, with accompanying return main, and with separate return risers for each coil or heater. These several return risers must not connect with each other except below the water line of the boiler. When properly constructed this method will be perfectly noiseless, and the air in the pipes is readily disposed of. This system should always be used in private houses and in buildings where extremely low pressures are employed.

3rd. *Main steam pipes and risers* with corresponding return mains, but without separate return risers, the steam risers conveying the water of condensation back through a relief to the main return pipes on floor of basement.

4th. *A single pipe system* in which there is but one steam pipe run from the top of the boiler and thence vertically to the several radiators which it is to supply –single branches being taken off for each. The water of condensation returns through these to the steam pipe, and considerable pitch is necessary to insure the water returning against the steam current.

This system is not advised except where the distances to be run horizontally are small, and the radiating surfaces standing nearly in a line above the other.

5th. *A single pipe for every heater* runs direct from the top of the boiler, rising continually toward the heaters, and with sufficient area to allow the steam to rise to the heaters, while the water of condensation is returned through the same pipes to the boiler. This system is identical with that described in No. 4, except that the steam supply pipe being subdivided there is less difficulty likely to occur from conflict of the currents of steam and water of condensation.

By systems Nos. 3, 4, and 5, a slight saving in the first cost of the apparatus is made, consisting of a return line of piping, and rendering necessary but a single valve for each of the heaters. These systems are not, however, recommended except for very small apparatus.

The low pressure gravity apparatus depends for a circulation on the difference of level of water in the return riser and the boiler, without regard to the steam pressure in any part of the distributing pipes, but the maximum pressure of steam carried must never exceed the equivalent of a difference in the level of the water between the water line of the boiler and the lowest point of the distributing main.

To return the water of condensation in the apparatus directly to the boiler under all conditions of pressure, the main pipes must be large enough to maintain the pressure of the boiler to within one pound in every part of the apparatus, and the water line of the boiler should be not less than four feet from the bottom of the horizontal main at its lowest part, though somewhat less difference in level can be used with safety, provided a less difference of pressure is carried between the flow and return mains.

Steam Boilers.—Boilers for steam warming should have few parts, and be as simple in their construction as it is possible to make them. They should admit of easy access for cleaning and repairs, and be capable of evaporating as much water as the pipes can condense in equal times. The most economical size is a medium one, and a departure therefrom occasions a loss of effect, a very large or small boiler giving less duty for fuel consumed than a medium size properly proportioned to the work to be done. Boilers are recommended that have the largest amount of direct fire surface with a medium of indirect surface, as it is desirable in house heating to have slow combustion in order to reduce as much as possible the necessary attendance.

To Estimate Size of Boiler.—For boilers of moderate heating surface, such as have been in general use for house warming, the ordinary method of estimating the size of boiler has been, first, to obtain the amount of steam likely to be condensed by the radiating surface, and from this adapt the boiler accordingly.

Economy is, however, chiefly obtained by so proportioning the boiler that for every square inch of grate area there should be the largest practicable amount of heating surface over which the flame and smoke are to be passed and cooled on their way to the flue. It is obvious that the more nearly the gases are cooled to the actual temperature of the boiler before being ejected, the less heat is lost and the greatest number of units retained for each pound of coal burned.

It has been found by actual experiment that vertical tube radiators emit about $2\frac{1}{2}$ heat units per square foot per hour for each degree difference between temperatures of the pipe surface and the surrounding air; so that with pipe surface at 212 degrees and the air at 70, their difference in temperature would be 142 degrees. This, then, multiplied by the above $2\frac{1}{2}$ units, gives an emission of 318 heat units per hour per square foot of surface.

There are approximately 1,000 heat units in a pound of steam, and hence each square foot of surface would condense about .31 lbs. of steam per hour.

In practice like the above, where the boiler surface is deficient and the products of combustion pass to the chimney at a higher temperature than they should, one square foot of boiler surface will evaporate approximately $2\frac{1}{3}$ lbs. of water per hour, and $2\frac{1}{3}$ lbs. divided by .31 gives a ratio of 1 square foot of boiler to about 8 square feet of radiating surface in the apparatus.

Radiators are the most important feature in connection with a steam or hot water plant; those most generally used throughout Canada and the United States are cast-iron, with concave surfaces and *Screwed Nipple Connections*. The only Radiator made on this principle is the "Safford," which by experts has been tested and found superior to all other forms of radiation upon the market. It is found that greater possibility of ornamental designs are to be had by the use of "Safford" Radiators. Cast-iron being homogeneous gives off heat with greater freedom, representing a superiority over wrought-iron as a Radiator of from 18 to 25 per cent.

Indirect Radiation and Ventilation

Is shown very clearly by the accompanying engraving. All the radiating surface, consisting of a "stack" of cast-iron loops (as shown on page 41), is placed in the cellar, and is encased in an air-tight box communicating with the outside atmosphere by a flue.

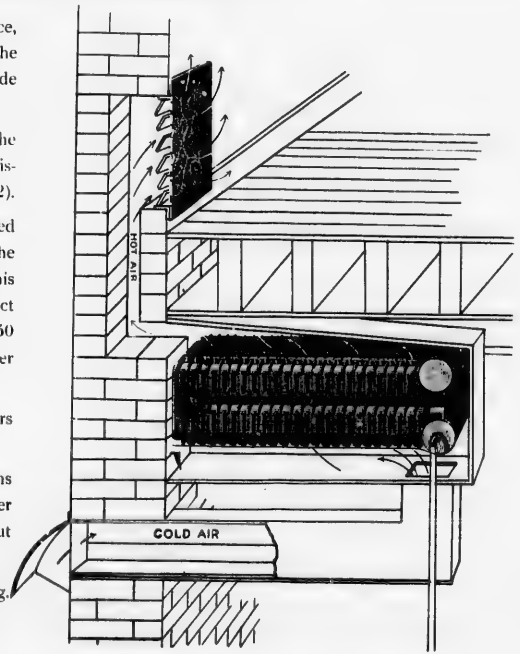
The steam is admitted to the stack and is there condensed, heating the cold air which flows around it, which ascends, and by means of flues is distributed throughout the several apartments (see specification pages 131 and 132).

The air is thus thoroughly warmed, but is not superheated or contaminated with gases, as in the case with a furnace; hence fresh warm air flows into the rooms whenever the registers are open. The ventilation obtained by this method of heating is absolutely perfect, but is not quite as economical as direct radiation, as it requires a larger amount of radiating surface in the stacks (50 per cent. increase), uses more steam, and consequently requires greater boiler capacity.

It is a most agreeable method of heating, and avoids the use of radiators in the rooms, thus saving floor space.

It is universally conceded desirable to use both indirect and direct systems —that is, by warming all or part of the first floor by the indirect, and the upper floors by the direct system, which gives perfect ventilation, and the cost is but little above that of the (entire) direct system.

On pages 134 and 135 we present plans of the indirect system of heating.



Safford Radiators — Flow and Return Pipes

To proportion pipe areas to radiating surface the use of multipliers is convenient. When the surface to be supplied exceeds 2,500 feet, multiply the number of square feet by .01 for indirect radiation, and by .008 for direct radiation, and the product gives the approximate area of pipe in square inches. The actual size of the pipe will be the pipe which has the area NEAREST to that found by the calculation.

SIZES OF FLOW AND RETURN PIPES APPROXIMATELY PROPORTIONED TO SURFACE IN RADIATORS

BY JOHN J. HOGAN

Size of Pipe Nominal Diameter Inches	MAINS		BRANCHES AND RISERS			
	Square Feet of Surface in Indirect Radiators in Cellar or Basement.	Square Feet of Surface in Direct Radiators on one or more floors, Average.	Square Feet of Surface in Radiators on First Floor, 0 ft. to 15 ft. above level of hre.	Square Feet of Surface in Radiators on Second Floor, or 15 ft. to 25 ft. above level of hre.	Square Feet of Surface in Radiators on Third Floor, or 25 ft. to 35 ft above level of hre.	Square Feet of Surface in Radiators on Fourth Floor, or 35 ft. to 45 ft above level of hre.
¾				40	45	50
1			50	75	80	85
1¼	100	135	110	120	135	150
1½	135	220	180	195	210	230
2	225	350	290	320	350	370
2½	320	460	400	490	525	550
3	500	675	620	650	690	730
3½	650	850	820	870	920	970
4	850	1100	1050	1120	1185	1250
4½	1050	1350	1325	1400	1485	1560
5	1350	1700				
6	2900	3600				
7	3900	4800				
8	5000	6200				
9	6300	7700				
10	7900	9800				
11	9500	11800				
12	11400	14000				

Wrought-Iron Welded Pipe

FOR STEAM, GAS, WATER, OR OIL.

1 inch and below, butt-welded; prove to 300 pounds per square inch, hydraulic pressure.
1¼ inch and above, lap-welded; prove to 500 pounds per square inch, hydraulic pressure.

TABLE OF STANDARD SIZES

Inside Diameter. Nominal.	Actual Outside Diameter.	Thickness.	External Circumference.	Length of Pipe, per Square Foot of Radiating Surface.	Actual Internal Area.	External Area.	Length of Pipe Containing One Cubic Foot.	Weight per Foot of Length.	No. of Threads per Inch of Screw.	Contents in Gallons per Foot.
	Inches	Inches	Inches	Feet	Inches	Inches	Feet	Lbs.		
⅛	.405	.068	1.272	9.44	.0572	.129	2500.	.243	27	.0 006
¼	.54	.088	1.696	7.075	.1041	.229	1385.	.422	18	.0026
⅜	.675	.091	2.121	5.657	.1916	.358	751.5	.561	18	.0057
½	.84	.109	2.652	4.502	.3048	.554	472.4	.845	14	.0102
¾	1.05	.113	3.299	3.637	.5333	.806	270.	1.126	14	.0230
1	1.315	.134	4.131	2.903	.8 27	1.357	166.9	1.670	11½	.0408
1¼	1.66	.140	5 215	2.301	1.496	2.164	96.25	2.258	11½	.0658
1½	1 9	.145	5.969	2.01	2.038	2.835	70.65	2 691	11½	0918
2	2 375	.154	7. 01	1.611	2.355	4.430	42.36	3.067	11½	.1632
2½	2 875	.204	9.032	1.328	4.783	6.491	30.11	5.773	8	.2550
3	3.5	.217	10.995	1.091	7.388	9.621	19.40	7.547	8	.3673
3½	4.	.226	12.566	.955	9.887	12.566	14.50	9 055	8	.4998
4	4 5	.237	14.137	.849	12 730	15.904	11.31	10.728	8	.6528
4½	5.	.247	15.708	.705	15.9 9	19.635	9.03	12.492	8	.8263
5	5 563	.250	17.475	.620	19.900	24 299	7.21	14.564	8	1.020
6	6 625	.280	20.813	.577	28.889	34.471	4.98	18.767	8	1.469
7	7.625	.301	23.954	.505	38.737	45.663	3.72	23 110	8	1.999
8	8.625	.322	27.096	.444	50.031	58.426	2.88	28 318	8	2.611
9	9.688	.344	30.433	.394	63.633	73.715	2.26	34.677	8	3.300
10	10.75	.366	33.772	.355	78.838	90.762	1.80	40.041	8	4.081

Heating Surfaces

To approximate the amount of heating surfaces for warming buildings (to 70 degrees at zero weather), much depends upon the class of building to be heated; it is necessary to provide for window surface and leakage in windows, also number of exposed walls. Much blame is attached at times, by the inexperienced, to the inability of the furnace to do the work, and in this we ask you to hesitate and ascertain if the Radiation provided is of the construction having large full water-ways, as small passages create friction, and friction means increased consumption of fuel and hard work for the furnace. Safford Radiators are the only Heaters made with large and unobstructed water-ways.

We give below a table which may be of use in calculating radiating surfaces:

PROPORTIONING SURFACE IN RADIATORS TO CUBIC CONTENTS OF APARTMENTS

External Temperature 0° Fahr. Internal Temperature 70° Fahr. Temperature of Water in Radiators 160° Fahr.

Description of Appartments Warmed.	Direct Radiation.	Indirect Radiation.
	One Square Foot of Surface in Radiators, Heats.	
Dwelling apartments on first floor	25 to 35 cubic feet	15 to 25 cubic feet
Dwelling apartments on second and upper floors	30 to 45 "	20 to 30 "
Dwelling bath rooms	15 to 25 "	10 to 20 "
Dwelling halls	20 to 30 "	15 to 25 "
Schoolrooms, offices, etc	30 to 60 "	25 to 40 "
Factories, stores, etc	45 to 70 "	25 to 40 "
Auditoriums, churches, etc	80 to 100 "	50 to 80 "

Care must be exercised to provide for any special conditions, such as exposure of building, material for construction, location, and length and size of mains governing plant under consideration.

In estimating the radiating surface, it should be borne in mind that a large surface at a comparatively low temperature gives a much pleasanter atmosphere than a small surface at a high temperature.

Excess of surface is no discomfort, since the temperature can easily be controlled by varying the fire or by valve on Radiator.

Weight per Foot of Wrought Iron Pipe

Size.	Weight.	Size.	Weight
⅜ inch	1.126 lbs.	3½ inch	9.055 lbs.
1 "	1.670 "	4 "	10.728 "
1¼ "	2.258 "	4½ "	12.492 "
1½ "	2.604 "	5 "	14.564 "
2 "	3.667 "	6 "	18.767 "
2½ "	5.773 "	7 "	23.271 "
3 "	7.547 "	8 "	28.189 "

Table of Pressure due to Height

Feet Head	Equals Pressure Per Sq. Inch	Feet Head	Equals Pressure Per Sq. Inch	Feet Head	Equals Pressure Per Sq. Inch
1	0.34	35	15.16	70	30.32
5	2.16	40	17.32	75	32.48
10	4.33	45	19.49	80	34.65
15	6.49	50	21.65	85	36.82
20	8.66	55	23.82	90	38.98
25	10.82	60	25.99	95	41.15
30	12.99	65	28.15	100	43.31

Table of Expansion of Wrought and Cast Iron Pipe to within One-Hundredth part of an Inch.

Temperature of the Air when the Pipe is Fitted	Length of Pipe when Fitted	Length of Pipe, when Heated to							
		215° or 1 lb. of Steam		265° or 25 lbs. of Steam		297° or 50 lbs. of Steam		338° or 100 lbs. of Steam	
Degrees, Fahr.	Feet	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
0	100	100	1.72	100	2.12	100	2.31	100	2.70
32	100	100	1.47	100	1.78	100	2.12	100	2.45
64	100	100	1.21	100	1.61	100	1.86	100	2.19
Cast Iron									
0	100	100	1.59	100	1.96	100	2.20	100	2.50
32	100	100	1.36	100	1.65	100	1.96	100	2.27
64	100	100	1.12	100	1.43	100	1.73	100	2.00

TABLE SHOWING THE RELATIVE AREAS OF STANDARD WROUGHT IRON GAS, WATER, AND STEAM PIPE, FROM ⅛ TO 9 INCHES INCLUSIVE

Sizes	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	7	8	9
⅛	1	4	9	16	36	64	81	144	256	400	576	784	1024	1600	2304	3136	4096	5184
¼		1	2¼	4	9	16	25	36	64	100	144	196	256	400	576	784	1024	1296
⅜			1	1⅞	4	7⅛	11⅛	16	28⅜	44⅛	64	87⅛	113⅞	155⅝	256	348⅜	455⅛	574⅝
½				1	2¼	4	6¼	9	16	25	36	49	64	100	144	196	256	324
¾					1	1⅞	2⅝	4	7⅛	11⅛	16	21⅞	28⅛	44⅛	64	87⅛	113⅞	144
1						1	1⅜	2¼	4	6¼	9	12¼	16	25	36	49	64	81
1¼							1	1¼	2½	4	5¼	7¾	10⅝	16	21½	31⅜	40¾	51¼
1½								1	1⅞	2⅞	4	5⅛	7⅛	11⅛	16	21⅞	28⅛	36
2									1	1⅜	2¼	3⅛	4	6¼	9	12¼	16	20¼
2½										1	1¼	1⅝	2½	4	5⅛	7⅛	10⅝	12¼
3											1	1⅛	1⅞	2⅞	4	5⅛	7⅛	9
3½												1	1⅛	2⅜	2⅞	4	5½	5⅞
4													1	1⅜	2¼	3⅛	4	5⅛
5														1	1⅝	2¼	2½	3⅝
6															1	1⅜	1⅞	2¼
7																1	1⅛	1⅜
8																	1	1⅛

Example—To find how many ⅛ inch pipes it takes to equal 1 inch pipe, we find the smaller size (⅛ inch) in first column on the left, and follow the line to the larger size at top of table, and thus find that our 1 inch pipe is equal to 64, ⅛ inch pipes.

THE POWER OF CHIMNEYS TO STEAM BOILERS, HAVING FLUES 100 FEET LONG IN CIRCUIT FROM FURNACE TO CHIMNEY

BY THOMAS BOX

Size at the Top Inside		40 Feet		60 Feet		80 Feet		100 Feet		120 Feet		150 Feet	
		Round	Square	Round	Square	Round	Square	Round	Square	Round	Square	Round	Square
Feet	Inches	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.	H.P.
1.	0.	6.4	8.1										
1.	3.	10.9	13.9	12.8	16.3								
1.	6.	16.6	21.0	19.5	24.8	21.7	27.5						
1.	9.	23.6	30.0	27.9	34.2	31.1	40 0						
2.	0.	31.9	41.0	37.3	47.5	42.3	53.8	45.7	58.2				
2.	3.			49.4	62.8	55.3	70.4	60.0	76.4	63.8	81.2		
2.	6.			65.3	83.1	70.4	90.0	76.5	97.4	81.	103.	85.	108.
2.	9.			78.	100.0	88.	112.	94.9	121.	101.	128.	106.	135.
3.	0.			94.	123.0	106.	135.	114.	145.	123.	157.	130.	165.
3.	6.					150.	191.	163.	207.	175.	223.	186.	237.
4.	0.					202.	257.	220.	280.	235.	300.	252.	321.
5.	9.							360.	458.	388.	494.	415.	528.
6.	0.									577.	734.	615.	783.

NOTE—The power of the Chimneys in this table is three-fourths of their absolute maximum power; thus the maximum power of a chimney 3 ft. 6 in. diameter, 80 ft. high, is $\frac{150 \times 4}{3} = 200$ horse-power, etc.

Safford Radiators

Contract and Specification for Hot Water Heating Apparatus

To 189

We submit herewith specification and tender for construction of a first-class Hot Water Heating Apparatus in your .....

Furnace—Furnish complete, and set up in basement ..... No. ..... Hot Water Boiler, with smoke stack same size as opening on top of Boiler, a full set of fire tools to accompany the same.

Radiators—Provide and fit up in apartments to be heated "Safford" Patent Radiators Pattern, containing in all ..... square feet of surface, made up as follows:

Heights	20½ in.	26½ in.	32½ in.	38½ in.	42½ in.
Square feet					

Expansion Tank—Furnish and set in place one heavy Galvanized Iron Tank, fitted with all necessary mountings.

Piping—Provide and fit two (1¼ in. and 1¼ in.) supply and return pipes from Boiler to Heaters, the supply and return to be the same size and separate for each floor, and must be carefully graded and so arranged as to obtain a free circulation of hot water through every heater with a low fire.

All main and return pipes to be properly suspended from basement ceiling with cast or wrought-iron hangers of best make, fastened to timbers overhead.

Ceiling and Floor Plates—Where pipes pass through floors or ceilings, the openings shall be fitted with nickel-plated ceiling and floor plates.

Temperature Regulator—Provide one No. 4 Powers Temperature Regulator (and connect same to system) to automatically regulate the temperature of the building to any degree of heat desired from 55 to 70 degrees Fahr.

Hot Water Specification—*Continued.*

Valves and Air Cocks—Each radiator to be furnished with a nickel-plated wood wheel radiator valve of full opening; also with a nickel-plated air cock with wood wheel.

Tank—Provide automatic water tank to supply water to the system, to be placed at least three feet above the highest radiator, and fitted with automatic ball cock, also globe and check valve, and connect with 1¼ inch overflow pipe direct to drain.

Blow-off Cock—furnish, feed, and draw-off cock of proper size.

Covering—All supply and return pipes in basement to be well covered with ¾ inch hair felt and canvas, securely sewn on.

Bronzing—All radiators and exposed pipes above cellar to be neatly bronzed, or painted plain, as owner may select.

Carpenter Work—All carpenter work to be paid for by owner.

Extras, Changes, and Alterations—Any alteration or deviation from the plans agreed upon, involving extra expense, will be subjected to an additional charge.

The workmanship and materials used to be of the best description, and the apparatus to be left perfect and in good running order.

Proposal—We offer to construct and furnish a Hot Water Heating Apparatus, complete, in accordance with the above specification, for the sum of ..... dollars ($.....).

Terms—Payments to be made as the work progresses, at the rate of ..... per cent. of the value of work done and material deposited; the balance to be paid within 30 days after completion of the work.

Note—The contractors for this work do not hold themselves responsible for delays occasioned by strikes, or other causes beyond their control; nor will they be responsible for the safety of a heating apparatus while being run for temporary heating,, unless the same is in charge of their own employees.

Safford Radiators

Specification for a Low Pressure Steam Heating Apparatus

For Heating by the DIRECT System, with a Steam Pressure of from one to five pounds per square inch.

Boiler—Furnish and erect in the cellar, in position as shown on plans.....boiler....., of the latest improved design; the said boiler to be guaranteed of ample capacity to furnish all steam required by the radiators.

Fixtures—Furnish for said generator the following improved attachments, viz.: One steam gauge, one safety valve, one water column, one glass water-gauge (with fixtures), three gauge cocks, and all valves, pipes, and fittings necessary to render their connection to the boiler complete.

Regulator—Furnish with boiler one Powers Temperature Regulator, No. 3, and connect same properly to boiler, for the purpose of automatically controlling the temperature of the building.

Fire Tools—Furnish with boiler the following tools, viz.: One hoe, one poker, one slice bar, and one steel flue brush of suitable size.

Smoke Pipe—Connect the boiler to chimney by means of smoke pipe, of suitable dimensions, with damper in same.

System of Piping—The system of piping throughout will be constructed and erected on the "Double Pipe Gravity Return" plan, and all runs of pipe will be of ample size to readily perform the service for which they are designed.

Steam and Return Piping—Furnish and erect runs of horizontal supply and return mains, as shown on the plans; all such runs to be carefully graded, and run in true straight lines, and all horizontal overhead piping to be suspended from ceiling by means of adjustable pipe hangers. From the supply and return mains, branch connecting pipes will be run to and connected with the radiators on first story, and to lines of vertical "riser pipes" which connect with the radiators on second story; also provide the necessary vertical drip pipes from "riser pipes," connected into a main return pipe, and discharging into the boiler, insuring the active delivery of dry steam to the radiating surface, and the easy flow of water of condensation back to the boiler. Side by side with supply main, erect a line of main-air pipe, and from such air main extend branch lines with each line of "riser pipes," and to all radiators.

Specification Low Pressure Steam—*Continued.*

Radiators—Provide and fit up in different apartments to be heated ..... "Safford" Patent Steam Radiators.. ..... Pattern, containing in all ..... square feet of surface, made up as follows:

Heights	20½ in.	26½ in.	32½ in.	38½ in.	42½ in.
Square feet					

Radiators—The radiators to be located in the positions as shown on the plans, and where the radiator stands in front of window it shall not be higher than the sill.

Ceiling and Floor Plates—Where pipes pass through floors or ceilings, the openings shall be fitted with telescope tin thimbles, and furnished with cast iron or spun metal plates (nickel-plated), as the case may require.

Radiator Valves—All supply and return connections to radiators will be provided with full-sized "Jenkins" Seat Radiator Valves, with wood-wheel handle, with union, and nickel-plated mountings.

Air Valves—Each radiator to have attached to it an automatic air valve (plated), of the Eureka or "Jenkins" pattern, and connected to the line of air pipe.

Quality of Material—All materials used in construction af this apparatus are to be the best of their respective kinds. All fittings to be heavily beaded, and of the best gray iron, and with clean-cut threads.

Painting and Bronzing—All cellar pipes not otherwise covered, and the exposed ironwork of the boiler, will be painted two coats, with the best black japan varnish; and all exposed piping above the cellar will be handsomely finished in gold bronze; two coats of flat colored paint to be put on the radiators, and relieved in bronzes of the best quality of shades, to be chosen by proprietor.

Pipe Covering—All cellar pipes (both supply and return) will be neatly covered with best one-inch hair felt and canvas, securely sewn on.

Guarantee—The apparatus, when completed, is guaranteed to be of ample capacity to readily and noiselessly supply all steam required by the radiating surfaces to maintain an even temperature of 70 degrees Fahr. in each of the rooms in which radiators are located, when the outside temperature is at zero. And if after a years use the said radiators or any part of the apparatus be defective in workmanship material or principal or insufficient to secure above results the same to be made right by the Contractor —without Charge—

Specification for a Low Pressure Steam Heating Apparatus

For heating by the INDIRECT System, with a Steam Pressure of from one to five pounds per square inch.

Boiler—Furnish and erect in cellar, in position as shown on cellar plans ..... boiler..... of the latest improved design, guaranteed to be of ample capacity to supply all steam required by the radiators.

Fixtures—Furnish for said boiler the following improved attachments, viz.: One steam gauge, one safety valve, one water column, one glass water gauge (with fixtures) three gauge cocks, and all pipes, valves, and fittings necessary to render their connection to the boiler complete.

Regulator—Furnish with boiler one Powers Temperature Regulator, No. 3, and connect same properly to boiler, for the purpose of automatically controlling the temperature of the building.

Fire Tools—Also provide for said boiler, a hoe, slice bar, and poker for working the fire, and a flue brush, of suitable size.

Smoke Pipe—Connect the boiler to chimney by means of a galvanized iron smoke pipe, of suitable dimensions, with damper in same.

System of Piping—The system of piping throughout will be constructed on the "Double Pipe Gravity Return" plan, and the several rooms heated will receive their heat from radiating surfaces of Indirect Radiators set in clusters or "stacks," each hung from near the ceiling of the cellar, and the heat from these "stacks" will be conveyed to the room to be heated by means of tin warm-air pipes set in the walls and leading from cellar to the room to be heated; each room heated to have an independent "stack," and to be connected therewith by an independent tin warm-air pipe. Each of the "stacks" of Indirect Radiators will be enclosed in a neat and well-made box or casing, made of galvanized iron, and from each "stack" there will be a galvanized iron duct, of proper size, leading to the nearest window, where the same shall be connected, to have opening to admit cold or fresh air to the "stack."

Steam and Return Piping—Furnish and erect all supply and return main and branch or connecting pipes, of the correct sizes, and located in the relative positions shown on plans, all piping to be graded and properly dripped, and to be hung in position by means of expansion pipe hangers.

Specification Indirect Steam—*Continued.*

Indirect Radiators—Furnish and erect in cellar, in the positions as shown on plans.....“stacks” of Safford “Climax” Pattern Indirect Radiators, containing in all.....square feet of radiating surface, made up as follows:

.....	“Stacks” to contain	.....	square feet of surface.		
.....	“	“	.....	“	“
.....	“	“	.....	“	“
.....	“	“	.....	“	“
.....	“	“	.....	“	“
.....	“	“	.....	“	“

Valves—The supply and return connecting pipe to each “stack” will be provided with a globe shut-off valve, and each “stack” will have an approved automatic air valve attached to it.

Pipe Covering—All cellar pipes will be neatly covered with one-inch thick hair felt and canvas, securely sewn on.

Registers—Furnish and set in position in each room heated a vertical wheel register, of the size shown on plans. All registers for first story to be bronze finish, and all others to be black or white japan finish, as shall be selected.

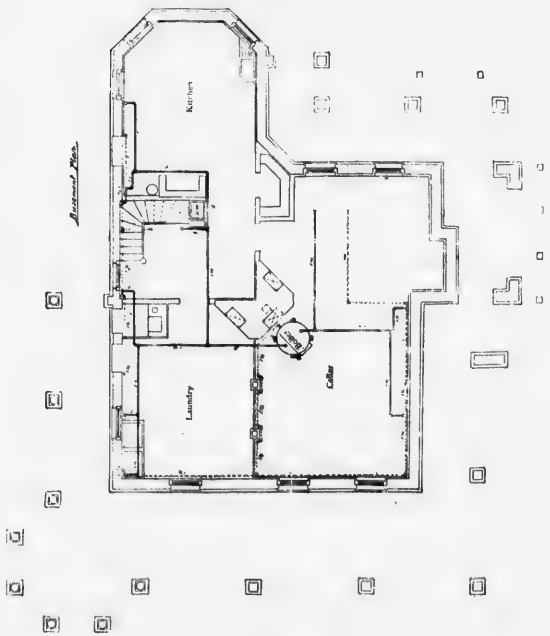
Tin Wall Pipes—Furnish to builder (and by him to be set in position as shown on plans) all tin wall pipes for warm air to the rooms to be heated, all to be made of 1 X tin, and of the sizes shown on plans.

Galvanized Iron Work—Furnish and erect in cellar, as shown on plan, galvanized iron casings or boxes for the “stacks,” and to each “stack” from the nearest window a galvanized iron duct, to conduct fresh air to the “stacks,” all to be of the sizes and dimensions shown on plans, and to be constructed in a substantial and workmanlike manner. Each fresh air duct to be provided with a damper.

Quality of Material—All materials used in the construction of this apparatus are to be of the best of their respective kinds; all fittings to be heavily beaded, and made of the best gray iron, with clean-cut threads.

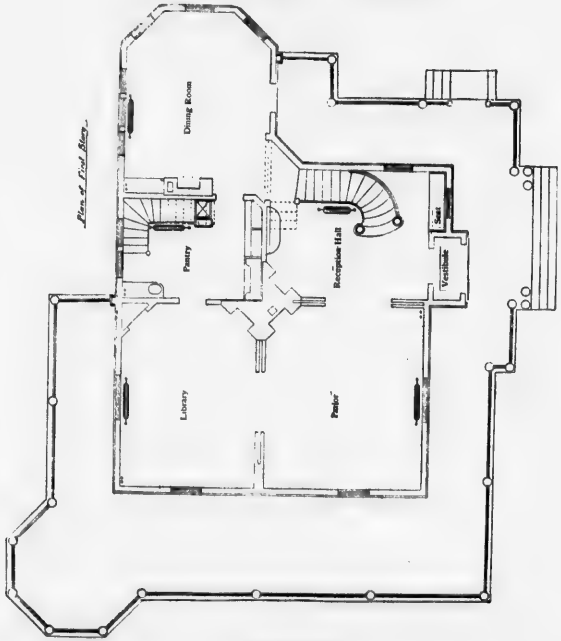
Guarantee—The contractor guarantees that the apparatus when completed will be of ample capacity to maintain an even temperature of 70 degrees Fahr. in the rooms heated, when the outside temperature is zero; and that the apparatus will afford free circulation throughout, and be noiseless in operation.

Plan of "Direct" Heating



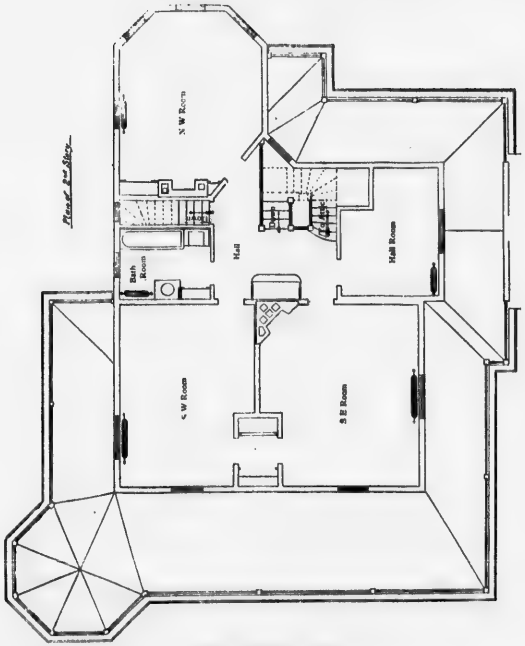
PLAN OF BASEMENT.

Plan of "Direct" Heating



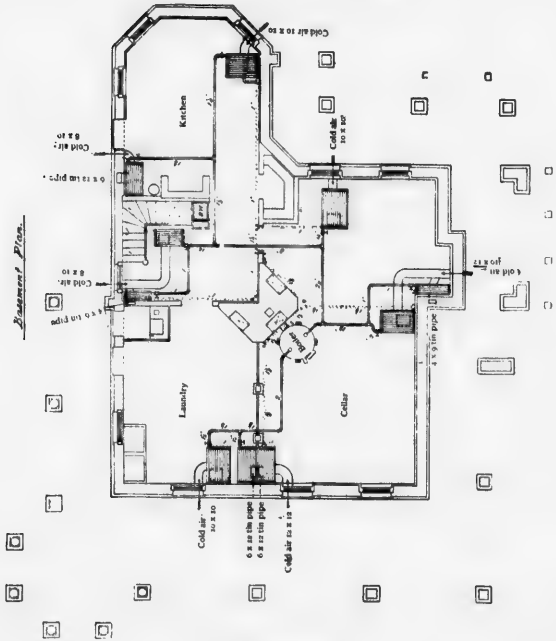
PLAN OF FIRST STORY.

Plan of "Direct" Heating



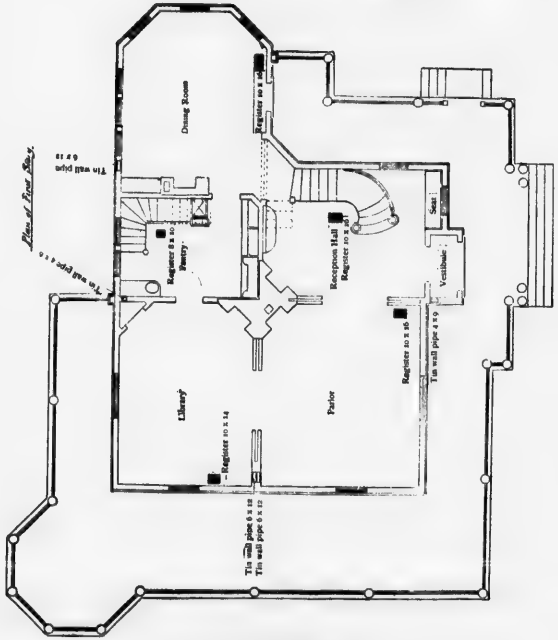
PLAN OF SECOND STORY.

Plan of "Indirect" Heating



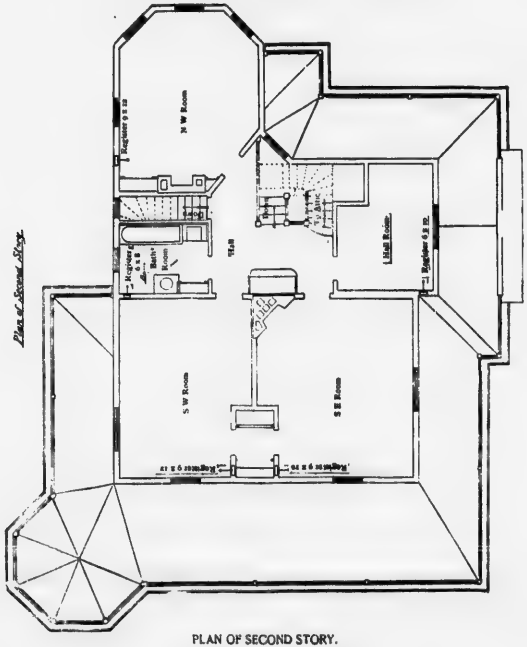
PLAN OF BASEMENT.

Plan of "Indirect" Heating



PLAN OF FIRST STORY.

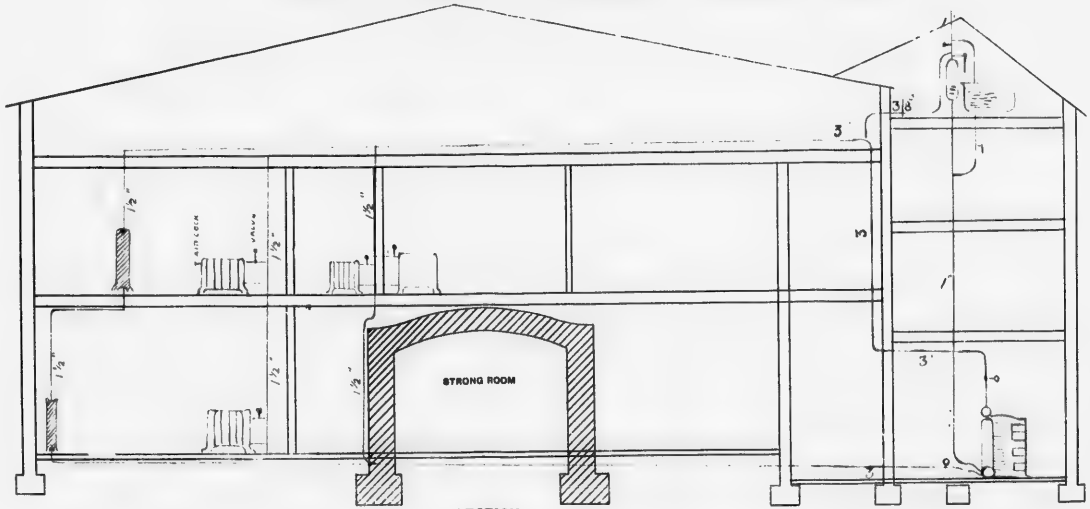
Plan of "Indirect" Heating



PLAN OF SECOND STORY.

ON PAGES 136 TO 139 WE SHOW AN OVERHEAD SYSTEM OF HOT WATER HEATING FOR THE

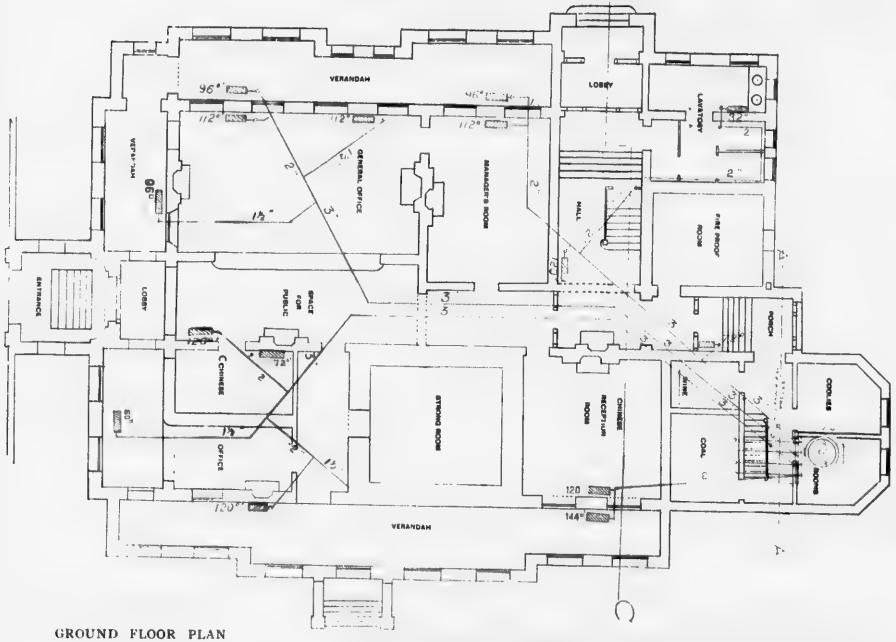
Bank of Hongkong and Shanghai, Tentsin, China



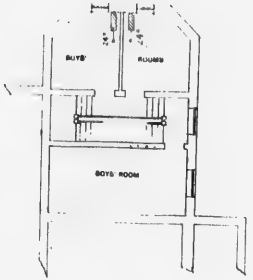
SECTION

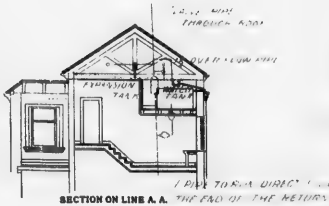
SECTIONAL VIEW SHOWING POSITION OF BOILER AND RISE OF PIPES

Bank of Hongkong and Shanghai, Tentsin, China



GROUND FLOOR PLAN

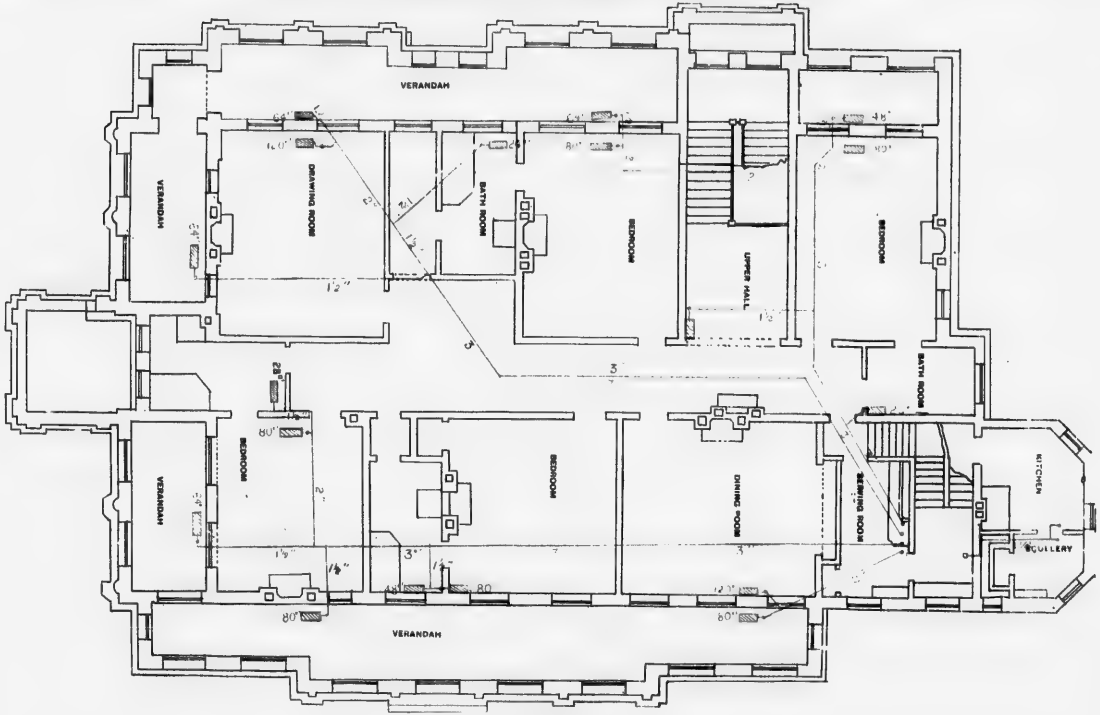




SECTION ON LINE A. A.

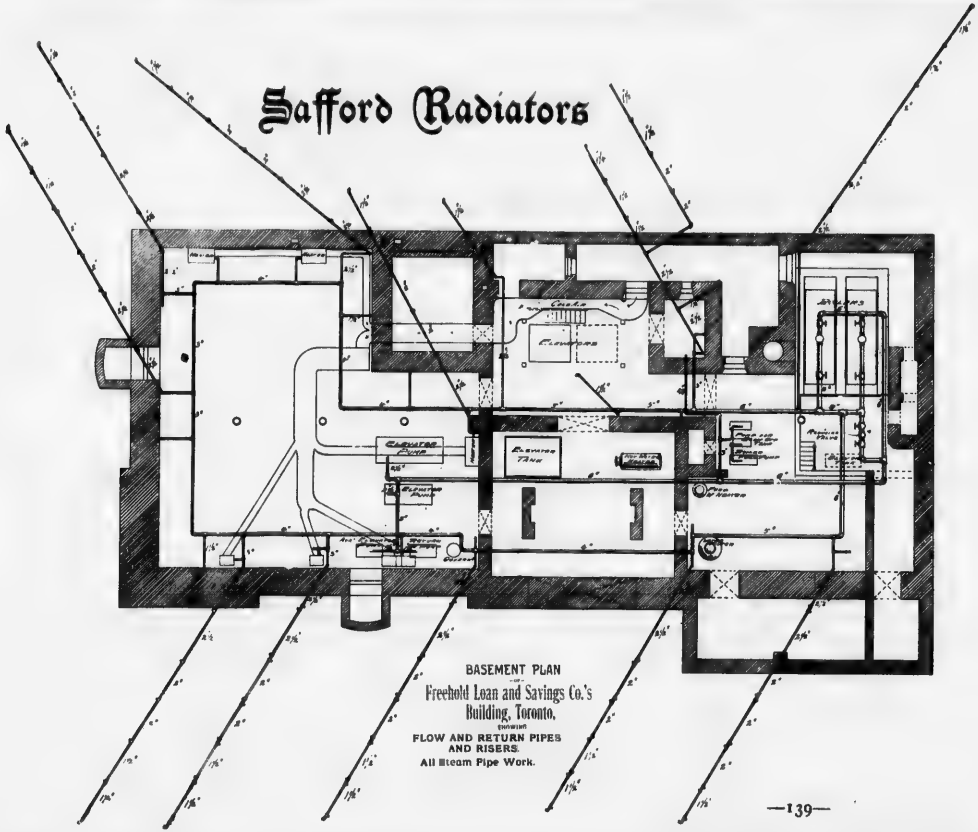
RED LINES SHOW SUPPLY AND RETURN MAINS

Bank of Hongkong and Shanghai, Tentsin, China



FIRST FLOOR PLAN

Safford Radiators



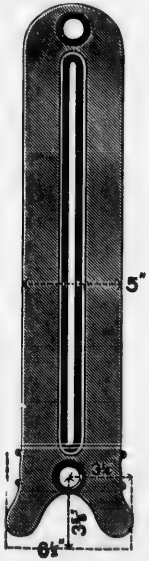
BASEMENT PLAN
of
Freehold Loan and Savings Co.'s
Building, Toronto,
showing
FLOW AND RETURN PIPES
AND RISERS.
All Steam Pipe Work.

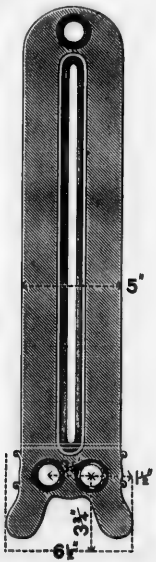
2 Loop,

Dimensions in Inches of "Safford" Loops

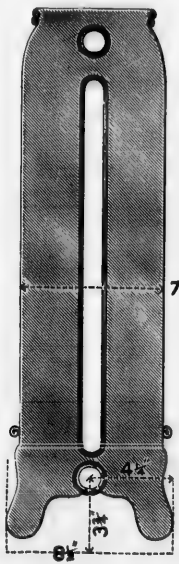
THE DIFFERENT HEIGHTS ARE EXACTLY THE SAME IN WIDTH AND DISTANCES FROM CENTRES TO FLOOR LINE

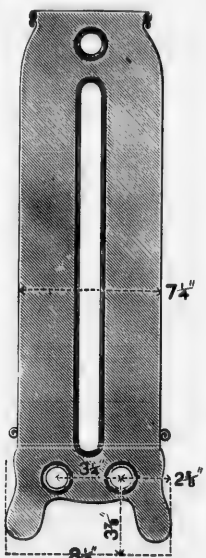
2 Loop, Favorite and Daisy Patterns



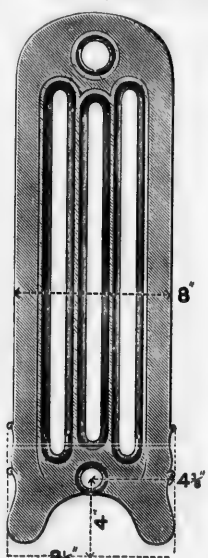


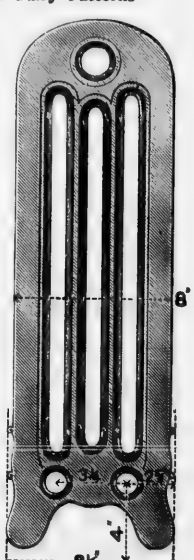
Perfect, Plain, and Provincial

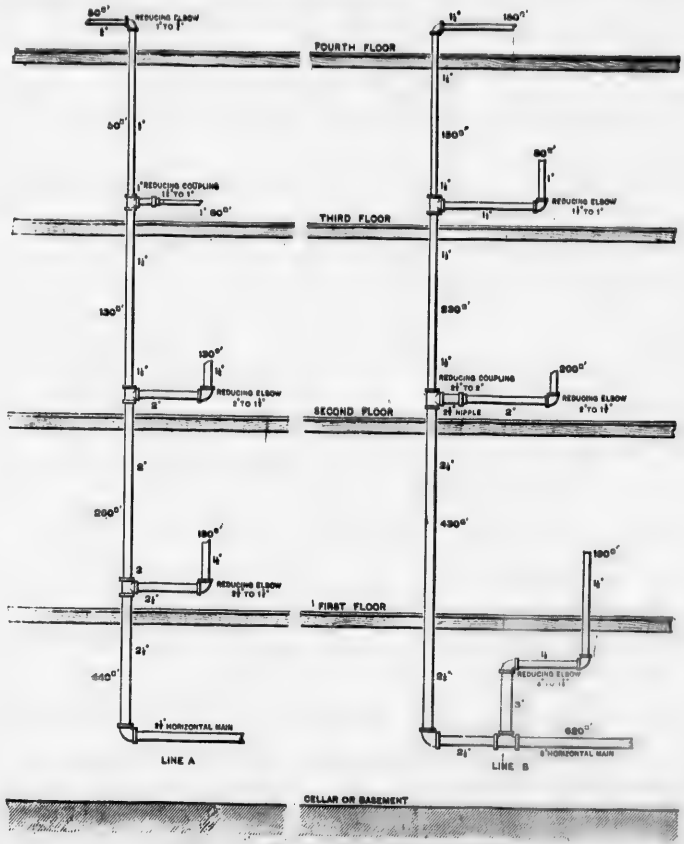




4 Loop, Favorite and Daisy Patterns





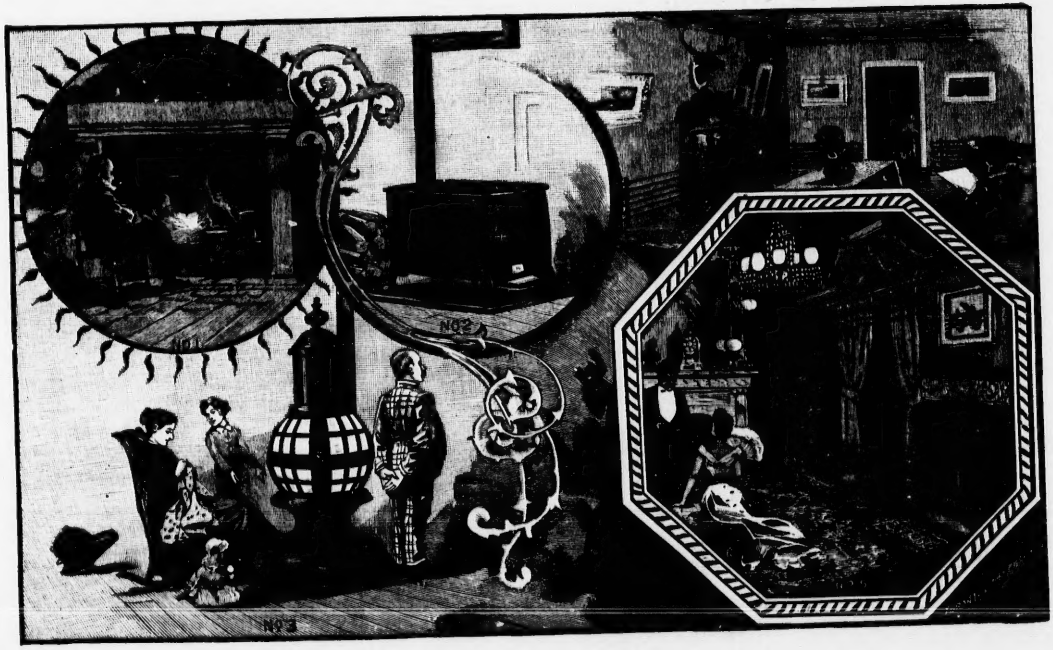


—Diagram of Vertical Lines of Pipe Proportioned to Obtain Uniform Temperatures.

TABLE OF CANADIAN CURRENCY, NOMINAL AND ACTUAL VALUE, AND THE EQUIVALENT IN STERLING

By Mr. John Brown, Toronto

Nominal Value in $	Actual Value in Canadian Currency of Sterling at Par of Exchange.	Equivalent in Sterling to Actual Canadian Currency at Par of Exchange. £	s.	d.
1	.99868		4	1½
2	1.99736		8	2½
3	2.99604		12	3¾
4	3.99979		16	5½
5	4.99847	1	0	6½
6	5.99715	1	4	7¾
7	7.00000	1	8	9¼
8	7.99858	1	12	10½
9	8.99826	1	16	11¾
10	10.00201	2	1	1¼
11	11.00069	2	5	2½
12	11.99937	2	9	3¾
13	13.00012	2	13	5¼
14	14.00180	2	17	6½
15	15.00048	3	1	7¾
16	15.99916	3	5	9
17	17.00291	3	9	10½
18	18.00159	3	13	11¾
19	19.00027	3	18	1
20	20.00402	4	2	2½
21	21.00270	4	6	3¾
22	22.00138	4	10	5
23	23.00006	4	14	6¼
24	23.99874	4	18	7½
25	25.00249	5	2	9
26	26.00117	5	6	10¼
27	26.99985	5	10	11½
28	27.99853	5	15	0¾
29	29.00218	5	19	2¼
30	30.00086	6	3	3½
31	31.99954	6	7	4¾
32	32.00329	6	11	6¼
33	33.00197	6	15	7½
34	34.00065	6	19	8¾
35	34.99933	7	3	10
36	36.00308	7	7	11½
37	37.00176	7	12	0¼
38	38.00044	7	16	2
39	38.99912	8	0	3½
40	40.00287	8	4	4¾
41	41.00155	8	8	6
42	42.00023	8	12	7½
43	43.00398	8	16	8¾
44	44.00266	9	0	10
45	45.00134	9	4	11¼
46	46.00002	9	0	0½
47	46.99870	9	13	1¾
48	48.00245	9	17	3¼
49	49.00113	10	1	4½
50	49.99981	10	5	5¾
51	50.99849	10	9	7
52	52.00224	10	13	8½
53	53.00092	10	17	9¾
54	53.99960	11	1	11
55	54.99828	11	6	0½
56	56.00203	11	10	1¾
57	57.00071	11	14	3
58	57.99939	11	18	4¼
59	59.00314	12	2	5½
60	60.00182	12	6	7
61	61.00050	12	10	8¼
62	61.99918	12	14	9½
63	63.00293	12	18	11
64	64.00161	13	3	0¼
65	65.00029	13	7	1½
66	65.99897	13	11	2¾
67	67.00272	13	15	4¼
68	68.00140	13	19	5½
69	69.00008	14	3	6¾
70	69.99876	14	7	8
71	71.00251	14	11	9¼
72	72.00119	14	15	10½
73	72.99987	15	0	0
74	73.99855	15	4	1¼
75	75.00230	15	8	2½
76	76.00098	15	12	4
77	76.99966	15	16	5¼
78	77.99834	16	0	6½
79	79.00209	16	4	8
80	80.00077	16	8	9¼
81	80.99945	16	12	10½
82	81.99813	16	16	11¾
83	83.00188	17	1	1¼
84	84.00056	17	5	2½
85	84.99924	17	9	3¾
86	85.99792	17	13	5
87	87.00167	17	17	6¼
88	88.00035	18	1	7½
89	88.99903	18	5	9
90	90.00278	18	9	10¼
91	91.00146	18	13	11½
92	92.00014	18	18	1
93	92.99882	19	2	2¼
94	94.00257	19	6	3½
95	95.00125	19	10	5
96	95.99993	19	14	6¼
97	96.99861	19	18	7½
98	98.00236	20	2	9
99	99.00104	20	6	10¼
100	99.99972	20	10	11½



A Study in Heating